2013 Report Card for America's Infrastructure Findings

Capital investment needs for the nation's wastewater and stormwater systems are estimated to total $298 billion over the next twenty years. Pipes represent the largest capital need, comprising three quarters of total needs. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. In recent years, capital needs for the treatment plants comprise about 15%-20% of total needs, but will likely increase due to new regulatory requirements. Stormwater needs, while growing, are still small compared with sanitary pipes and treatment plants. Since 2007, the federal government has required cities to invest more than $15 billion in new pipes, plants, and equipment to eliminate combined sewer overflows.

Wastewater: Conditions & Capacity

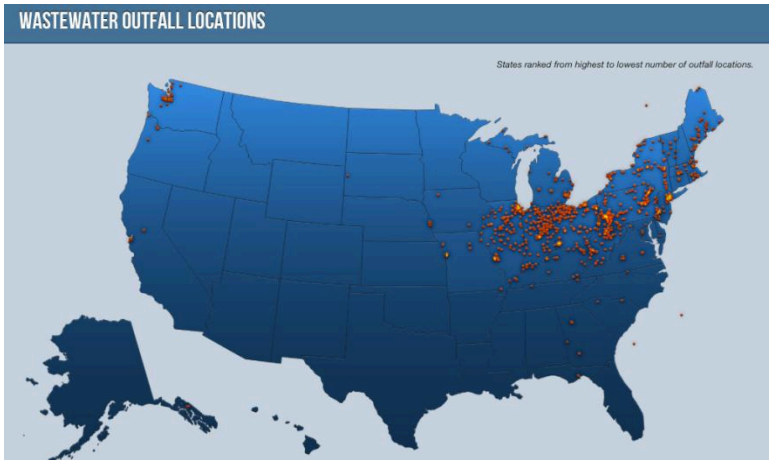
There are between 700,000 and 800,000 miles of public sewer mains in the United States. Many of these pipes were installed after World War II, meaning they are now approaching the end of their useful life. Capital investments in those pipes account for between 80% and 85% of all wastewater system investment requirements in the United States.


The Groundwater Replenishment System (GWRS) takes highly treated wastewater that would have previously been discharged into the Pacific Ocean and purifies it using a three-step advanced treatment process consisting of microfiltration, reverse osmosis and ultraviolet light with hydrogen peroxide.
Courtesy of Orange County Water District

The United States has approximately 14,780 wastewater treatment facilities and 19,739 wastewater pipe systems as of 2008. In 2002, 98% of publicly owned treatment systems were municipally

owned. Although access to centralized treatment systems is widespread, the condition of many of these systems is also poor, with aging pipes and inadequate capacity leading to the discharge of an estimated 900 billion gallons of untreated sewage each year.

The problems associated with aging wastewater treatment systems are daunting. To cite one example, Indianapolis' antiquated sewage system dumps close to 7.8 billion gallons of sewage and storm water into creeks and rivers each year. The city now is carrying out a $3.1 billion sewage infrastructure project designed to trap and purify most of the sewage before it washes into the city's streams.



At the start of the 21st century, many of those neglected systems are in need of maintenance and repairs. Most assessment reports by government agencies and interest groups agree that the bill amounts to hundreds of billions of dollars over the next two decades. In 2009, the Environmental Protection Agency (EPA) reported to Congress that the states had assessed 16% of America's stream miles and found that 36% of those miles were unfit for use by fish and wildlife, 28% were unfit for human recreation, 18% were unfit for use as a public water supply, and 10% were unfit for agricultural use.

One symptom of the problem of aging pipes is represented by CSOs, which affect more than 700 American cities and towns and represent a major challenge to the implementation of the Clean Water Act, which regulates sewage treatment. During periods of significant rainfall, the capacity of a combined sewer may be exceeded. When this occurs, excess flow, a mixture of storm-water and sanitary wastewater, is discharged at CSO points, typically to rivers and streams. Release of this excess flow is necessary to prevent flooding in homes, basements, businesses, and streets.


Aerial view of wastewater treatment plant in Orange County, California
Courtesy of Orange County Water District

EPA and the U.S. Justice Department have made eliminating CSOs a national priority. Since 2007, the agencies have signed consent decrees under the Clean Water Act requiring cities operating publicly owned treatment works (POTWs) to invest more than $15 billion in new pipes, plant, and equipment to eliminate CSOs. Some cities, however, are employing nonstructural solutions to address the problem of CSOs at lower overall cost and with good results for the environment.

Wastewater: Investment & Funding

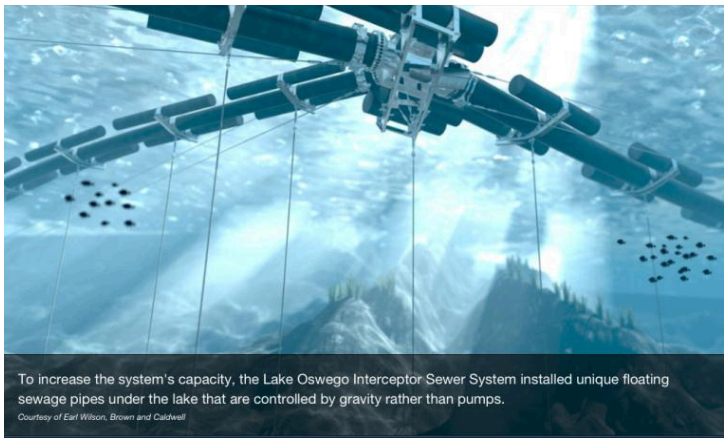
Wastewater infrastructure in the United States is aging, and investment is not able to keep up with the need. State and local governments incur approximately 98 percent of the capital investments annually to maintain and improve the infrastructure. In 2008, state and local governments estimated their total expenditures at $93 billion annually for wastewater and drinking water infrastructure.

The Congressional Budget Office, EPA, and other groups have estimated that it could take more than $300 billion to address the nation's sewage collection and treatment infrastructure needs over 20 years to keep our surface waters safe and clean. This is twice the current level of investment by all levels of our government. Congressional appropriations have declined over the five-year period 2008 to 2012, totaling only $10.5 billion—an average of $2.1 billion annually or $42 billion over 20 years.

Capital needs for wastewater and stormwater are largely to address pipes, treatment systems themselves, and federal stormwater requirements. By far, pipes represent the largest capital need, comprising three quarters of total needs in recent years. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. Capital needs for the treatment plants themselves comprise only about 15%-20% of total needs in recent years. Storm-water needs, while growing, are still small compared with sanitary pipes and treatment plants.

In 2008, EPA reported that the U.S. 20-year investment needs for aging wastewater treatment totaled just over $298 billion, or almost $15 billion annually. The total represented a 17% increase over the 2004Clean Watershed Needs Survey (CWNS) results. Meanwhile, annual appropriations for the Clean Water State Revolving Fund (CWSRF) totaled $9 billion over the five years from 2008 to 2012, an average of slightly more than $1.8 billion annually, well short of the annual need. Congressional appropriations totaled approximately $10.5 billion between 2008 and 2012—about $2.1 billion annually or $42 billion over 20 years, 14% of the 20-year needs.

Of the total needs, over $202 billion in the CWNS was the nationwide capital investment needed to control wastewater pollution for up to a 20-year period. The 2008 report included estimates of $134 billion for wastewater treatment and collection systems, $55 billion for combined sewer overflow corrections, and $9 billion for storm-water management.



To increase the system's capacity, the Lake Oswego Interceptor Sewer System installed unique floating sewage pipes under the lake that are controlled by gravity rather than pumps.
Courtesy of Earl Wilson, Brown and Caldwell

Wastewater: Success Stories

Portland, Oregon, Lake Oswego Interceptor Sewer System (LOIS)

Portland's Lake Oswego Interceptor Sewer System (LOIS) was not large enough to manage the

increasing volume of wastewater. Pipes were too small to handle passing sewage flows from the service area, and the aging system was plagued with corroded pipes and supports that were believed susceptible to earthquake damage.

The system's pipe replacement project began in 2009 and was completed in 2012. The upgrade involved the installation in the lake of replacement pipe that is buoyant and attached to the lake bottom with anchors and tethers. The pipe floats 8 to 17 feet below the surface of the lake. Like the existing interceptor sewer, the new system will be a gravity line, meaning that changes in elevation from the west end of the lake to the east will keep material moving through the line without the need for pumps.

The new LOIS satisfies one of ASCE's key solutions for infrastructure by promoting sustainability and resilience through expanding infrastructure capacity and protecting the system against natural hazards. The project is a candidate for an Outstanding Civil Engineering Achievement Award (OCEA) from ASCE in 2013.

The Milwaukee Sewerage District

The Menomonee River is one of three primary rivers in Milwaukee, Wisconsin. A large swath of the river has been heavily channelized and industrialized as it runs through the Menomonee Valley. This has become a primary source of pollution for the river.
Courtesy of Vincent Desjardin

The Milwaukee Metropolitan Sewerage District (MMSD) is a regional government agency that provides water reclamation and flood management services for about 1.1 million customers in 28 communities in Greater Milwaukee. It has adopted a watershed-based permitting plan, a nonstructural approach that protects the environment and promotes sustainability, one of ASCE's key elements for raising the grade of America's infrastructure in 2013.

Touring the Oceanside Treatment Plant, which is run by the San Francisco Public Utilities Commission
Courtesy of Christina Castro

"MMSD's holistic approach to water management works on a watershed level. MMSD's cutting-edge pilot watershed-based permitting (WBP) focuses on a holistic, innovative geography-based approach to discharge permitting. WBPs extend to the natural boundaries of watersheds rather than being confined to political jurisdictions or industries. WBP conditions and expected outcomes are designed to meet core program requirements of the Clean Water Act (CWA), while tailoring management measures to the needs and characteristics of specific Milwaukee-area watersheds."

The San Francisco Public Utilities Commission

Over the past five years, the San Francisco Public Utilities Commission (SFPUC) has finished a number of energy efficient projects to its facilities. These projects include the production of biofuel from brown grease which clears pipes of grease, solar panel installations to create sustainable energy, and retrofitting municipal street lights to conserve city power. Along with these sustainable upgrades, SFPUC is also making targeted investments in groundwater use, grey water reuse, water conservation, rain water harvesting, and storm water management.

The Massachusetts Water Resources Authority


MWRA Egg Digester POTW
Courtesy of Massachusetts Water Resources Authority

The Deer Island wastewater treatment plant in Massachusetts uses five treatment steps, which eliminate 80 to 90 percent of the contamination. Raw sewage is pumped to various head works in the Boston area, which remove large debris and gritty material. From the head works, the sewage flows to Deer Island. Next, solids are removed in the primary settling tanks, where 50 to 60 percent of total suspended solids and as much as 50 percent of pathogens and toxic contaminants are removed. In the secondary-treatment phase, the plant uses microorganisms and pure oxygen to consume 80 to 90 percent of the remaining organic and toxic wastes. Much of the microbe-rich sludge is recycled back to the secondary aeration process, but some is removed and mixed with the concentrated primary sludge, then heated, consolidated, and anaerobically digested in the plant's "egg digesters." The resulting biosolids are shipped to MWRA's pelletizing facility in Quincy, where they are processed into fertilizer.

Wastewater: Conclusion

Wastewater systems will incur growing costs over the next 20 years as they expand capacity to serve current and future growth. Other costs will result from stricter permitting standards, nutrient removal requirements, technology updates, and new process methods, among others. Beyond budget and financing options, the nation needs to consider multiple solutions to the wastewater infrastructure quandary.

Raising the Grades: Solutions that Work Now

- **Raise awareness for the true cost of water.** Water is vital for our everyday life, but we pay much less for it than cable, or any other utility. Current water rates do not reflect the true cost of supplying clean, reliable drinking water. Replacing the nation's antiquated pipes will require additional local investment, including higher water rates.
- **Reinvigorate the State Revolving Loan Fund (SRF) under the Clean Water Act** by reauthorizing minimum federal funding of $20 billion over five years.
- **Eliminate the state cap on private activity bonds for water infrastructure** projects to bring an estimated $6 billion to $7 billion annually in new private financing to bear on the problem.
- **Explore the potential for a Water Infrastructure Finance Innovations Authority (WIFIA)** that would access funds from the U.S. Treasury at Treasury rates and use those funds to support loans and other credit mechanisms for water projects. The loans would be repaid to the Authority and then to the U.S. Treasury with interest.
- **Establish a federal Water Infrastructure Trust Fund** to finance the national shortfall in funding of infrastructure systems under the Clean Water Act and the Safe Drinking Water Act.
- **Separate Potable and Nonpotable Water.** A large portion of public supply water is used for watering lawns, flushing toilets, and washing clothes. These uses do not require potable water, but in most localities, all publicly supplied water is treated to meet federal drinking-water standards. It is becoming cost-effective for municipalities to construct separate lines for potable and nonpotable uses as water becomes scarcer and treatment more costly.