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| Work Session: | In-Depth Presentation: Special Districts |
| Title: | Large Diameter Water Main Breaks |
| Presenter: | Laura A. Swisher |
| Presenter's Title: | Associate Counsel |
| Presenter's Office: | Washington Suburban Sanitary Commission<br>14501 Sweitzer Lane<br>Laurel, MD 20707 |

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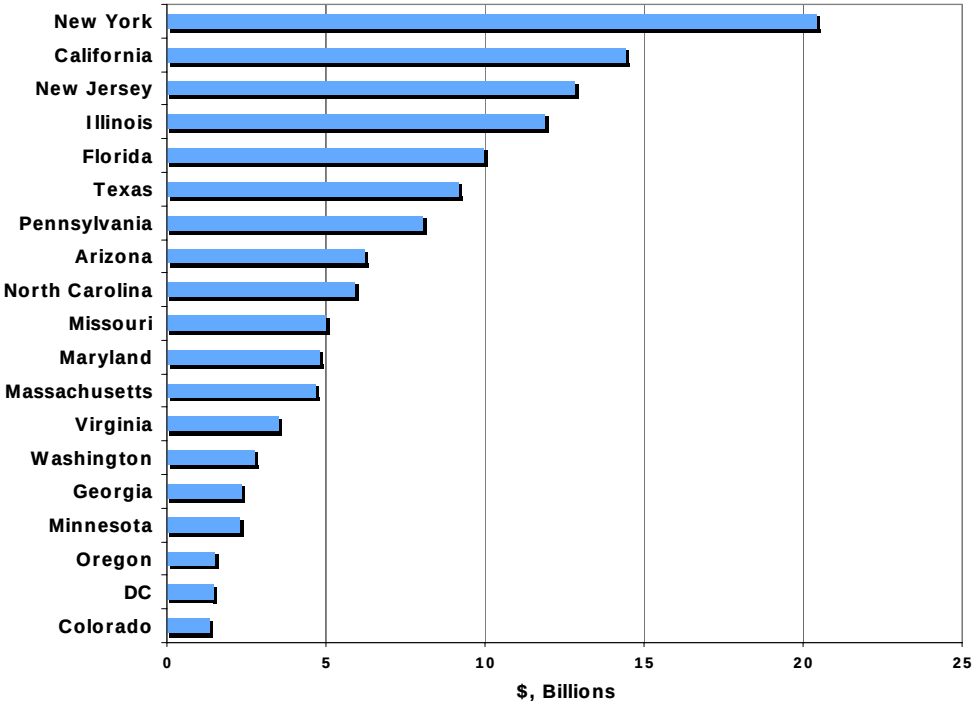
**Large Diameter Water Main Breaks –**
**The Problems and Potential Liabilities**

## The Big Picture

Aging infrastructure is one of the major challenges facing the nation. The 2005 American Society of Civil Engineers (ASCE) Report[1] gave U.S. infrastructure a "poor" rating based on the condition and performance of assets, capacity versus need, and funding versus need. Drinking water systems and wastewater systems were two of the three lowest graded categories of infrastructure, along with navigable waterways. Each of these categories was graded a "D-". It is estimated the nation's 55,000 drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities near the end of their useful life and to comply with existing and future federal water regulations. This shortfall does not account for any growth in the demand for drinking water over that time period.

Water System Infrastructure Needs over next 20 Years – by State[2]




This year, the Government Accounting Office (GAO) estimated that the nation's water infrastructure needs range from $485 billion to nearly $1.2 trillion

[1] American Society of Civil Engineers, *2005 Report Card for America's Infrastructure*, (March 2005), http://www.asce.org/files/pdf/reportcard/2005_Report_Card-Full_Report.pdf .

[2] Id.

over the next twenty years.[3] The largest category of that need is the installation and maintenance of transmission and distribution systems – accounting for $183.6 billion or 66% of the needs.[4] One of the reasons water systems are in such poor repair is because they consist, in large part, of buried infrastructure. Buried infrastructure is easy to ignore as it is out of sight, and condition assessments are not readily available.

The problems created by aging water system infrastructure include the increased frequency of leaks, main breaks, taste, odor and red water complaints, reduced hydraulic capacity due to internal pipe corrosion, and increased disinfectant demands due to the presence of corrosion products, biofilms, and regrowth.[5] This paper addresses concerns posed by the increasing failure rate of water mains, particularly large diameter transmission mains and the potential risks and liability exposure associated with such pipeline failure.

## Large Diameter Water Mains – The Problems

*WSSC's system*

The Washington Suburban Sanitary Commission (WSSC) is a bi-county commission providing water and wastewater services to approximately 1.6 million customers in Montgomery and Prince Georges County, Maryland. WSSC owns 5,500 miles of water mains in a 1,000 square mile service area. Most of those mains are distribution mains; larger diameter transmission mains account for only 200 miles. Transmission mains range between 36 and 96 inches in diameter, and serve as the major distribution points of water throughout the service area. The majority of these mains were constructed from pre-stressed concrete (PCCP) or cast iron.

Many of WSSC's transmission mains have been in service for well over fifty years. As these pipes age, the risk of failure increases. Any water main break is problematic, but a large diameter transmission main failure can be catastrophic. When a pipeline of that size breaks, the initial explosive force is immense, and large amounts of pressurized water are released with an initial velocity of up to 90 miles per hour. In addition to the dangers to persons and property posed by the actual break and flooding, the impact to the system and customers is huge, and can effectively disrupt water service to large portions of the service area for days at a time.

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[3] Government Accounting Office, *Physical Infrastructure: Challenges and Investment Options for the Nation's Infrastructure*, GAO-08-763T (Washington, D.C.: May 8, 2008), http://www.gao.gov/new.items/d08763t.pdf .

[4] U.S. Environmental Protection Agency, *Clean Watersheds Needs Survey 2004 Report to Congress*, (Washington, D.C.: January 2008), http://www.epa.gov/cwns/2004rtc/cwns2004rtc.pdf

[5] GAO, *supra* note 3.

In the late 1990s, WSSC began requiring ductile iron and steel pipe materials for its large diameter pipelines. Mains constructed from these materials tend to leak before breaking, providing advance notice of failure. Although the WSSC has replaced some 72, 84, and 96-inch PCCP pipelines with steel or ductile iron, and has relined PCCP pipeline with steel over the years, 143 miles of the more problematic PCCP and cast iron pipeline remain in the system.

*Condition Assessment Program*

WSSC began a "pipe condition assessment" program in the 1980's, which focused on developing structural assessment tools and using these in the inspection and structural evaluation of large diameter transmission mains. Surprisingly, there are still few methods for testing the structural integrity of water mains, and the majority of the existing methods require that the mains be shut down and de-watered prior to their use.[6] This is problematic for transmission mains, as the system must maintain adequate pressure during such a shut down. Accordingly, these types of tests (as well as any planned repair or rehabilitiation) are limited to periods when the demand for water is low, usually winter or early spring, and areas of the system with existing redundancy.

Over the past several years, WSSC's ongoing assessment effort developed a corresponding "risk assessment" for each transmission pipeline in the program. A Safety Analysis Score was created, with possible scores of 0 to 250, with a higher score equating to higher risk. The following factors are considered in developing the Safety Analysis Score:

- Diameter of pipe – *larger diameter creates higher risk*
- Material used - *PCCP and cast iron have increased failure rates*
- Year of construction and manufacturing process – *some years have worse track record for materials*
- Proximity of buildings or structures

The resulting Safety Analysis Score is used to prioritize mains within the inspection and condition assessment program. In addition, WSSC is gradually introducing new 24/7 acoustic monitoring technology for those PCCP pipelines with high Safety Analysis Scores.

Recently, a significant increase in the number of high-density projects planned to develop land adjacent to large transmission mains raised three serious concerns. WSSC wanted to ensure that it maintained an adequate zone of safety; minimized the impact and risk to the transmission mains; and minimized future

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[6] For additional information on these issues, see U.S. Environmental Protection Agency, *Deteriorating Buried Infrastructure: Management Challenges and Strategies*, (Washington, D.C.: May 2002), http://www.epa.gov/safewater/disinfection/tcr/pdfs/whitepaper_tcr_infrastructure.pdf and *Structural Integrity Monitoring for Improved Drinking Water Infrastructure Sustainability*, http://www.epa.gov/ord/NRMRL/scienceforum/royer_m.htm

pipeline monitoring and rehabilitation costs, as proximity to buildings would automatically raise the main's Safety Analysis Score. Unfortunately, it was apparent that either WSSC's existing right-of-way and/or setback requirements were insufficient to address these concerns.

Some projects experienced design delays as WSSC sought to address these issues, but the developer's investment and the various projects' current stage of development were primary factors in WSSC's decision to adhere to current design standards in the review and approval of those projects. An Engineering Study was initiated to review current right-of-way widths, setback requirements, and manpower and budgetary resources required to address these concerns. In the interim, WSSC added the following language its Preliminary Plan, Rezoning, Service Category Change Requests and Hydraulic Planning Review responses:

> Public safety concerns may require special considerations and modifications of proposed development near large diameter water transmission pipelines.

*Engineering Study*

WSSC's Engineering Study reviewed available data on prior breaks within the WSSC system, and researched practices of other utilities in addition to the American Water Works Association and its affiliated Research Foundation. The Study focused on the size of the hole created, the area affected by the initial debris throw, and the area of flooding and water damage following a large diameter water main failure. Preliminary findings concluded that there was no need to increase the size of WSSC's existing right-of-way requirements as the current requirements were sufficient for operation and maintenance needs, but that the existing setback requirement of 25 feet from the centerline should be increased to establish a 'zone of safety'. The funding levels required for increased assessments, monitoring and required rehabilitation and replacements remains under review.

The recommendation for an increased setback from the centerline of pipe was based on the following findings:

1. The initial explosive break and subsequent washout creates a 'hole' between 35 and 50 feet in diameter from the centerline of the pipe;
2. Debris throw from the initial explosion averages between 30 and 210 feet; and,
3. The amount and velocity of water flow causes most damage and creates highest risk.

In light of these findings, staff recommended WSSC increase its setback requirement from 25 feet to 80 feet from the centerline of pipe for all 36-inch and larger diameter transmission mains. This setback distance was selected to keep structures outside the area of the 'hole' created, minimize the damage resulting from debris throw, and reduce the velocity and depth of water at the structure.

This proposal is currently under review by the Maryland National Park and Planning Commission, which handles planning and zoning review for WSSC's service area. Variance or special exception language would be incorporated to allow for site specific engineering conditions or solutions.

*Infrastructure Fund*

In a concurrent attempt to address these issues and the manpower and resources needed to address these concerns, WSSC staff proposed to add a surcharge to water bills to fund a major inspection and upgrade program. The surcharge, called the Infrastructure Fund charge, would have added about $20 dollars a month to typical residential bills. However, pressure from residents and state and local politicians resulted in the charge being removed from the budget by WSSC Commissioners. WSSC's General Manager at the time, Andrew Brunhart, told the Commissioners after they took that vote that without more money for infrastructure improvements, he would recommend dropping the words "entrusted", "reliable" and "clean" from the WSSC Mission Statement.[7]

*Increasing Breaks*

Meanwhile, WSSC had a record 2,061 water main breaks or leaks in 2007, averaging 6 breaks or leaks per day. Of those breaks, only 4 were transmission mains, and all 4 were the smallest 36-inch diameter mains. This June a 48-inch transmission main[8] broke, spilling an estimated 100 million gallons of treated water before the leak was located and the valves closed. Luckily, no personal injury or property damage occurred, as the break was located in an isolated area. However, the break disrupted water service to thousands of households in Montgomery County, Maryland, and required the closure of approximately 1,200 restaurants and other businesses that require potable water for three days until two rounds of tests confirmed that no harmful bacteria had entered the system during the shutdown. Swimming pools and day camps were closed for what would have been the first days of summer vacation. One hospital was close to evacuating until it found an alternate source of water for its cooling system, which requires thousands of gallons of water to keep the hospital temperatures regulated. The Montgomery County Health Department struggled to keep affected residents and businesses informed and up to date on the boil water advisory and its implications, and both the County and WSSC were inundated with questions from concerned citizens.

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[7] WSSC's Mission Statement - "We are entrusted by our community to provide safe and reliable water, life's most precious resource, and return clean water to our environment, all in an ethically and financially responsible manner."

[8] Note that this section of main was only 38 years old, and did not have a high Safety Analysis Score. The cause of this break is still under investigation.

## Potential Liability

Liabilities associated with water main breaks, especially transmission mains, can be considerable. Service disruptions can result in lost revenue and other risks to businesses such as hospitals, restaurants, commercial properties, dialysis centers, and laundry mats that rely heavily on water service. The WSSC has already received numerous claims for loss of business, mostly restaurants, resulting from the June transmission main break. Personal injury and property damage may also result, especially when the break occurs in a densely populated area. This section deals with the various theories of liability associated with water main breaks, and how some of those areas may be expanding in light of increasing deterioration of water systems across the country.

*State or Common Law Claims*

The traditional causes of action against a water utility following a water main break are basic tort claims for negligence, nuisance, or trespass. Local governments are under a duty of reasonable care, with the obligation to make reasonable inspections, exercising ordinary diligence in doing so, and then to act reasonably in correcting the defective or dangerous condition. The local government becomes negligent when, after actual or constructive notice of the defect, it fails to act reasonably to remedy the defect. If it fails to inspect, or negligently inspects, it may be held to the knowledge that a proper inspection would have revealed.[9] Claims for nuisance or trespass do not require the showing of any wrongdoing or negligence on behalf of the government. Some courts have found public water systems liable for contaminated water under products liability, or as seller of a 'good' under the Uniform Commercial Code, with an implied warranty of merchantability.[10]

*Federal Claims*

The Safe Drinking Water Act, 42 U.S.C.A. §300f, et seq., provides the primary federal regulatory framework for water quality standards, and establishes Maximum Contaminant Levels (MCLs) for over 60 contaminants for drinking water supplies. The Act also allows for a citizen's suit in the event of violation of the MCLs, and allows for the recovery of attorneys and expert fees.[11]

Colleagues report seeing claims for negligent inspection based on §1983 of the Civil Rights Act, though none have been successful. Title 42 U.S.C. §1983 provides a remedy for persons deprived of rights under the color of law by state or local government officials. While the statute states that any "person" may be

[9] LEXSTAT 3-40 Antieau on Local Government Law, Second Edition §40.08 (2008).

[10] Adel v. Greensprings of Vermont, Inc., 798, 363 F. Supp. 2d 692 (D. Vt. 2005).

[11] 42 U.S.C. §300j-8.

liable, the Supreme Court[12] held that a local government could also be sued if the execution of a government's policy or custom, whether made by its lawmakers or by those whose edicts or acts may fairly be said to represent official policy, inflicts the injury. Claims could be made for violations of the Equal Protection clause, alleging that a governmental entity failed to repair mains in a certain area based on considerations of race or income level. Such a claim would be easier to prove if comparable repairs had been made in other, more affluent areas.

Substantive Due Process claims are also conceivable, as while state or local governments have no affirmative duty to protect, a duty may be triggered if state conduct contributes to the danger. The harm caused must be foreseeable, and the conduct of the state and local officials must 'shock the conscience", which is currently a high burden to meet.[13] If, however, the officials have time to deliberate the issues, deliberate indifference to the foreseeable harm may be sufficient. Failure to fund needed infrastructure improvements, after being fully informed of the need and current condition of the assets, could be alleged to meet the test for deliberate indifference. Two recent law review articles debate both sides of this theory in detail.[14]

*Immunity Defenses*

Even if liability attaches, various governmental immunities may shield or limit liability for most of the above causes of action, depending on the type of entity, the nature of the claim, and the actions at issue. Other than mentioning the various federal, state and local government tort claims acts that may be applicable, this paper does not attempt to address these defenses.[15]

## Paying the Price

Moving forward, it is clear large diameter water mains will require significant funding, whether to cover costs associated with repair or rehabilitation of the older mains, or to pay the liability costs associated with continued failures. The 2008 GAO report[16] concluded that a large number of water utilities were not generating enough revenue from user charges and other sources to cover their full costs of service. One third of utilities defer required maintenance because of insufficient funds, and lack basic plans for managing their capital assets. Rate increases have been sporadic, due in large part to political opposition, and many utilities hope the federal government will be able to provide financial assistance.

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[12] Monell v. New York City Dept. of Social Services, 436 U.S. 658 (1978)

[13] Lombardi v. Whitman, 485 F.3d 73 (2d Cir. N.Y. 2007).

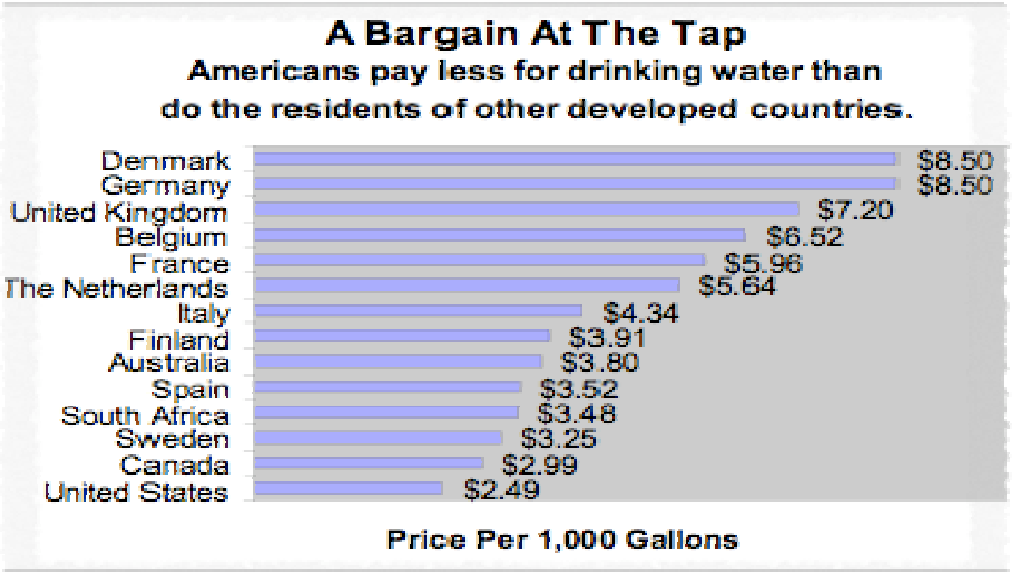
[14] *Issues in the Third Circuit: Bright v. Westmoreland County: Putting the Kibosh on State-Created Danger Claims Alleging State Actor Inaction*, 52 Vill. L. Rev. 1043 (2007); *Reining In Abuses Of Executive Power Through Substantive Due Process*, 60 Fla. L. Rev. 519 (2008).

[15] See Owen v. City of Independence, Missouri, et al., 445 U.S. 622 (1980) for a good discussion of immunities available to municipal entities and their historical basis.

[16] GAO, *supra* note 3.

However, funding levels associated with the Clean and Safe Drinking Water State Revolving Funds, the primary federal program supporting water infrastructure financing, have declined 24% since 2001, and should be expected to provide only minimal assistance in closing the funding gap.

When measured as a percentage of household income, the U.S. pays less for water than any other developed country. See diagram below.[17]




Americans consider water readily available and cheap. A fundamental shift of thinking in this area will be required to meet essential infrastructure needs. The US EPA is promoting what it calls 'Full Cost Pricing", or pricing that reflects the full costs of treatment and delivery.[18] This guidance may help utilities implement effective pricing structures, but that is not the current reality, and until then, water utilities across the country will face a catch 22 – either coming up with the funds needed to upgrade their failing infrastructure, or paying the costs associated with failure of that infrastructure.

[17] *Water Woes*, U.S. News and World Report (June 4, 2007).

[18] U.S. EPA, Full Cost Pricing, http://www.epa.gov/waterinfrastructure/fullcostpricing.html.