SILENT & UNSEEN

Coastal Historic Water Infrastructure Stewardship in the Face of Sea Level Rise
Practical Solutions: Structural Adaptations Panel
Urban underworld

A subway view of a Manhattan intersection reveals a tangle of subterranean systems: power, cable, water, steam, gas, and sewage lines. "It's a maze of pipes," says David Greenbaum, an engineer who helps builders navigate New York's "underground world." Whenever you dig, there is a problem.

A pedastrian says the city delayed building the subway for fear of disturbing the underground network. Even today, a steam or water pipe break can cause chaos. Fluids can leak and seep, and seepage can poison the drinking water. Deeper in the pipes in this illustration, an old break branches into storm water and sewage drains below.

DEEP WATER

Sewage

Geology

Transportation

Forgotten

Gas

Steam

Water

Cable

Power
Populations at risk

Percentage of national populations who live in places that will be drowned by a rise in long-term sea levels - even if global warming is held at 2C

- 0%
- 0.1-5
- 5-10
- 10-25
- 25-50
- 50-75
- 75-100

Guardian graphic

Source: Nature Climate Change
At the dawn of the 21st century, much of our drinking water infrastructure is nearing the end of its useful life. There are an estimated 240,000 water main breaks per year in the United States. Assuming every pipe would need to be replaced, the cost over the coming decades could reach more than $1 trillion, according to the American Water Works Association (AWWA). The quality of drinking water in the United States remains universally high, however. Even though pipes and mains are frequently more than 100 years old and in need of replacement, outbreaks of disease attributable to drinking water are rare.
LARGE PROTECTIVE ENGINEERED PROJECTS
New York City Watershed System

**Delaware System, 1940–1964**
- Consists of Cannonsville, Pepacton, Neversink, and Rondout Reservoirs, and the Delaware Aqueduct
- Provides 50% of the city's water supply
- Supplies 690 million gallons per day

**Croton System, 1842–1917**
- Contains 32 reservoirs, three controlled lakes, the Croton Aqueduct, and the Jerome and Central Park Reservoirs
- Provides 10% of the city's water supply
- Supplies 180 million gallons per day

**Catskill System, 1805–1928**
- Consists of Ashokan and Schuylerie Reservoirs, the Shandaken Tunnel, the Catskill Aqueduct, and the Kensico and Hillview Reservoirs
- Provides 45% of the city's water supply
- Supplies 600 million gallons per day

**In-city Distribution System, 1817–today**
- Consists of three water tunnels and water main network

Source: NYC Dept. of Environmental Protection
Blue roof pilot project in the Williamsburg neighborhood of Brooklyn
Rotterdam Delta City

Connecting water with opportunities
Borehole Technology

Abstraction Borehole

River Terrace Gravel
Clay
Chalk

Water Filtration Unit

Air Handling Unit
Complete with a cooling coil. Cooling coil is similar to a radiator but providing cooling instead of heating.

Cool Water from the Aquifer below London

Submerged Pump

Warmed Water returned to Aquifer at a distance from abstraction points
Water Supply
REHABILITATION
ADAPTIVE USE
“I guess in some ways this city is still the same”