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The Journal News (Westchester County, NY)

March 11, 2001 Sunday  
Correction Appended

**SECTION:** NEWS; Pg. 1A

**LENGTH:** 2428 words

**HEADLINE:** Down the drain

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**BODY:**

Aqueduct's condition raises fear of collapse

**Roger Witherspoon**

The Journal News

A billion gallons of water leak every month from the primary aqueduct that carries up to 70 percent of the water used by 9 million New York City and Westchester County residents, and city officials do not know how extensive the tunnel's problems are or how to fix them.

The city's Department of Environmental Protection insists that the likelihood of an aqueduct collapse is remote. But if it does, and DEP engineers acknowledge they do not know how fragile the underground tunnel may be, it is unclear how Westchester residents would get their drinking water and how a water shortfall would be met.

Engineers first detected leaks in the huge Delaware Aqueduct in 1990, but have not tried to stop them since. The leaks are somewhere under Roseton, near Newburgh in Orange County, and Wawarsing, 20 miles north in Ulster County.

By 1995, departmental reports show that the aqueduct was losing about 540 million gallons a month from the leaks. By 2000, that figure had nearly doubled to 1.02 billion gallons, about the same as the monthly usage in Rochester.

The DEP did not publicly disclose information about the leaks until last October, in response to a Freedom of Information request from Riverkeeper, an environmental law group based in White Plains. DEP Commissioner Joel Miele declined repeated requests from The Journal News for comment on the issue.

Engineers have monitored the loss in water from the aging aqueduct, built between 1939 and 1945, but they do not know the nature or number of leaks in the concrete and steel water tunnel, or how to seal them. The DEP plans to conduct soil boring tests later this year to find out the condition of the rock in the area of the leaks.

"No soil boring tests have been completed," said Jeff Odefey, a lawyer with Riverkeeper. "We do not know what we should know in the geology around the tunnel. We know that stretch passes through fractured limestone, which is soluble in

water. But to what degree that has happened we are not sure."

If the aqueduct collapses, Westchester officials in the county Department of Environmental Facilities say they have no contingency plans for the resulting water emergency. But they insist that the county would receive the same proportion of whatever water is made available to New York City as it does now. DEP officials, however, say the county's 1 million users could, and should, get their water elsewhere.

In a Dec. 8 briefing paper to the New York City Council, Kathleen Cudahy, director of the council's infrastructure division, wrote, "Westchester draws about 125 million gallons per day and, according to DEP, has alternate sources of water, which it will be called upon to use."

Riverkeeper and companies that distribute water throughout Westchester question the DEP's assertion that county residents would not be affected by a Delaware Aqueduct collapse. They say the other aqueducts that feed the system do not have enough water to meet the needs of both the city and county.

That is particularly true of the Croton water system, which frequently has unacceptable levels of pollution and is under a federal order to be filtered by 2007. The DEP is currently seeking a site for a filtration plant for the Croton Reservoir system, and is considering a location in Yorktown and one along the Greenburgh-Mount Pleasant border. The agency has avoided the need for a filtration system for the larger Delaware and Catskill systems only by blending water from the two.

Riverkeeper contends that the unfiltered Croton system would be overwhelmed by increased demand and would fail quality standards if the Delaware Aqueduct collapses.

The Delaware carries up to 960 million of the 1.35 billion gallons of water used daily by New York City and Westchester County.

In the decade since the aqueduct's leaks were first detected, DEP officials acknowledge that they have not examined the tunnel or determined the condition of the surrounding rock, do not know the precise locations and sizes of the various leaks and, because of its possibly fragile condition, will not be able to thoroughly examine the tunnel for at least two years.

Only then will engineers know for certain the nature and extent of the problems and be able to develop plans to correct them. Miele told a New York City Council committee last Dec. 8 that it was unlikely repairs would be made before 2007, nearly 20 years after the leaks were first detected.

Despite the department's lack of knowledge about the aqueduct's condition, Miele expressed confidence in the tunnel's structural integrity at a hearing before the council's Committee on Environmental Protection.

"Based upon extensive investigations into the condition of the aqueduct, the situation at present is that the possibility of complete failure of the aqueduct in the next five years is extremely remote," Miele said, according to a transcript of the hearing.

"Furthermore," he said, "the city's water supply system is extensive enough that

even if the aqueduct was taken out of service today because of a catastrophic failure, we could supply normal demand of 1,350 mgd (million gallons daily) for about three months, and then continue to supply approximately 1,000 mgd indefinitely, provided we continued to have the typical amount of precipitation."

Miele was countered at the hearing by Robert F. Kennedy Jr., chief prosecuting attorney for Riverkeeper, which has frequently sued the DEP over water quality issues.

"The claims made by the commissioner about the gravity of this crisis are not true," Kennedy said. "There is a good chance the only thing holding the tunnel together in that section is the pressure of the water in it, and it could suffer a catastrophic collapse, which could take years to repair. The city has 80 days or less of water once that tunnel does collapse."

The Delaware Aqueduct is the largest and most crucial part of the New York City water system's regional network. Built in three sections, it ranges from 13.5 to 19.5 feet in diameter and goes through bedrock at depths ranging from 300 to 2,400 feet.

Leaks in the aqueduct have created a freshwater spring, a small lake 4 feet deep and a 35-foot sinkhole in the Roseton area. The water is spewing from the leaks with such force that DEP officials and Riverkeeper concur that it may have eroded the limestone bedrock around the massive water tunnel, creating an unstable and heavy, water-filled slurry.

For that reason, the DEP is reluctant to empty and inspect the tunnel because the damaged rock could crush the aqueduct and shut it permanently. DEP officials suspect that the aqueduct is being kept open only by the pressure of the water going through it - the same pressure that apparently propelled water through weak seams and damaged the rock around it.

It is not clear what would happen if the aqueduct collapsed before the tunnel is repaired or a bypass is built. Westchester officials say there are no emergency plans for securing water if the system goes down. Instead, the county expects to get its fair share, roughly 10 percent, of whatever water New York City is able to use if the Delaware system closes.

The county maintains that position despite the DEP's contention that Westchester could get its drinking water elsewhere. It will likely take an aqueduct collapse or water shortage to settle the debate.

"That type of problem has such a magnitude it would go beyond Westchester County and be declared a federal disaster," said Gina D'Agrosa, the county's water master. "We would be working with federal and state agencies. We would all be in the same boat and everyone gets a trickle."

Robert Funicello, the county's director of environmental projects, said New York City could ask Westchester to tap other water sources if they were available. But in terms of cutting the county off and ordering it to look elsewhere, he said, "the city can't do that."

"The county has some emergency water supplies," Funicello said. "We've had to draw from the Hudson River to meet needs in the past. But that's quite apart from

any failure in the distribution system."

Funicello said there was no need to consider contingency water plans for Westchester because New York City is legally obligated to share whatever water it has. The Water Supply Act of 1905, which is now part of New York City's administrative code, states that the city must supply water to other municipalities in accordance with long-standing agreements, he said.

"They have to provide water on a per capita basis," Funicello said. "So if someone in the Bronx gets to take one bath per week, then someone in Yonkers gets one bath per week."

The New York City water system was considered an engineering marvel when it was designed and constructed between 1937 and 1945. According to Diane Galusha's "Liquid Assets: A History of New York City's Water System," it is the single largest man-made financial asset in the state and contains the world's longest continuous tunnel - the Delaware Aqueduct.

The entire system carries up to 1.5 billion gallons of water daily from 19 reservoirs over a 6,000-mile network of pipes, shafts and underground aqueducts.

The water is collected in two distinct systems in the Catskill Mountains and Hudson Valley. The first system, the Catskill and Delaware Watersheds, cover about 1,600 square miles of land in five counties about 100 miles northwest of New York City. The two watersheds contain six major reservoirs. The Delaware system provides up to 70 percent of the city's and Westchester's drinking water, while the Catskill system provides 20 to 40 percent.

The second system, the Croton Watershed, covers about 375 square miles in Westchester and Putnam counties and provides the remaining 10 percent of the city's and Westchester's drinking water. It has 10 reservoirs and three controlled lakes, and is connected to the Catskill and Delaware watersheds through a system of underground aqueducts.

All three watersheds feed into the Kensico Reservoir in Valhalla which, in turn, fills the Hillview Reservoir in Yonkers.

DEP spokesman Geoffrey Ryan said that if the Delaware Aqueduct closed, there would be little impact on the county because "most of southern Westchester gets water from the Kensico reservoir. It would continue to get water from the Catskill system."

But the Kensico is a balancing reservoir that receives water from all three systems, and more than half of its water comes from the Delaware Aqueduct.

"The Delaware is the best water, it is the Holy Grail of city water," Kennedy said in his testimony before the New York City Council. "And it is needed to dilute the other city supplies in order to bring them into compliance with a filtration order."

Firms that provide water to Westchester communities draw it from the Delaware and Catskill aqueducts as it flows down to the Hillview Reservoir. The loss of Delaware Aqueduct water would affect their ability to draw water from the Kensico Reservoir as it flows to Hillview.

"If the Delaware Aqueduct went out, everyone would be hurt," said John Hock, general manager of Westchester Joint Waterworks, which draws about 12.5 million gallons of water daily from the Delaware Aqueduct line flowing out of the Kensico.

That water drawn by the company serves the town and village of Mamaroneck, Harrison, Rye city, New Rochelle, Larchmont, Port Chester and Rye Brook.

The DEP acknowledges that the high pressure water pouring out of the Delaware Aqueduct may have crushed much of the rock around the steel-encased tunnel under Roseton, just west of the Hudson River. There also are geological faults that may have fractured the bedrock, according to DEP engineering reports. For those reasons, the department will not try to cut off water to the aqueduct for an internal inspection.

"They can't shut it down," Kennedy said in an interview, "because they are scared that the erosion caused by the leak has eroded the limestone geology that supports the aqueduct and it has liquefied and destabilized. If they de-water the aqueduct, it would collapse because the only thing holding it together is the internal water pressure."

In order to examine the tunnel's cracks, the DEP has considered having the Woods Hole Oceanographic Institute in Massachusetts design an autonomous submersible that could move freely in the fast moving water and photograph damaged areas.

After the DEP receives information from the submersible, it can conduct soil bore tests to determine the condition of the rock around the aqueduct throughout the leaking areas.

Miele, in testimony last July 21 in U.S. District Court in White Plains, said the submarine probes of the Delaware Aqueduct leaks were needed "because there is no other way to get at it." Miele's testimony came during a lawsuit involving the DEP's management of the department's Catskill Watershed Police.

"We got a contract to build that, and we have a contract basically to enter this vehicle into the tunnel and to have the vehicle go down to the area where the leak appears to be, so we can determine the extent of it," Miele testified, according to court documents.

Woods Hole spokeswoman Shelly Luzan said her organization submitted a proposal to the DEP in mid-1999, but did not receive a proposed contract from the department until last December. The contract was not signed until February, she said.

Ryan, the DEP spokesman, said the contract was for about \$2 million. Ryan, Miele and Miele's chief of staff, Charles Sturkin, would not comment on Miele's court testimony and the timing of the contract's signing.

A spokesman for Manhattan District Attorney Robert Morgenthau said the DA's office was reviewing the issue, based on a letter from Riverkeeper, to determine if a formal investigation should be launched against Miele.

Kennedy derided the DEP's actions in testimony before the New York City Council.

"You find a leak like this and the first thing you do is test the structural geology of the site by doing bore holes all around it. They have done none of that," he said.

"Instead, they have this submarine project," he said, "this kind of Jules Verne project that they claim they have been working on like Santa's elves for the past 10 years and, in fact, they have done nothing, nothing at all on this issue. The attitude is, 'Let's just cover this one up and get out of here before the dam bursts.' The problem is, who knows what it's done in eroding the geology down below?"

**CORRECTION:**

The New York City Department of Environmental Protection has publicly discussed significant problems with leaks in the Delaware Aqueduct. The department's disclosure of the leaks was incorrectly characterized March 11 on Page One.