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FOR IMMEDIATE RELEASE 16-102
October 7, 2016

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Department of Environmental Protection Will Use Remote Operated Vehicle to Examine the Interior of a Portion of the Catskill Aqueduct

Engineers to analyze pressure tunnel that carries water deep below the Rondout Valley

Historic photos of the Rondout Pressure Tunnel can be found by clicking here

The New York City Department of Environmental Protection (DEP) today announced that it will launch a remote operated vehicle next week to pinpoint suspected leaks in a portion of the Catskill Aqueduct that runs several hundred feet below the Rondout Creek in Ulster County. The vehicle will use high-definition video cameras, acoustic equipment and other instruments to examine this portion of the aqueduct, known as the Rondout Pressure Tunnel. Data gathered through that analysis will be used to design any necessary repairs. DEP anticipates those repairs would happen sometime after it completes ongoing work for the Delaware Aqueduct Bypass Tunnel under the Hudson River, which is scheduled to be finished in 2023.

What is the Rondout Pressure Tunnel?

The Rondout Pressure Tunnel is a 14.5-foot diameter pipe that stretches 23,608 feet from a wooded area north of Stone Ridge to a site within the Mohonk Preserve. Water within the Catskill Aqueduct travels at ground level before it enters the pressure tunnel, which plunges approximately 500 feet below the surface to convey that water under the Rondout Valley. It then rises back to surface level on the eastern side of the valley, where the water continues its journey south to Kensico Reservoir.

The Rondout Pressure Tunnel is the longest of seven pressure tunnels that allow the Catskill Aqueduct to carry drinking water beneath broad valleys that include creeks or rivers. Other pressure tunnels of the Catskill Aqueduct carry water below the Wallkill River, Moodna Creek, Hudson River, and New Croton Reservoir.

Pressure tunnels comprise about 15 percent of the total length of the 92-mile Catskill Aqueduct. About 55 miles of the aqueduct were built through “cut-and-cover” methods, where a trench was excavated and the aqueduct was built at the surface. About 14 miles of the aqueduct are grade tunnels that were cut through hills or mountains. Through the cut-and-cover and grade tunnel sections, water inside the Catskill Aqueduct is not under pressure; rather, water inside the aqueduct flows like an enclosed river. The remaining 23 miles of aqueduct is comprised of pressure tunnels and steel pipe siphons that plunge downward into the earth and then return to surface level. In these sections, the aqueduct is under great pressure from water pushing down on itself and outward on the aqueduct walls.

More Information

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Rondout Pressure Tunnel leaks

DEP believes the Rondout Pressure Tunnel developed leaks in at least three locations. The location of only one leak – believed to be the largest – is known for certain. That leak is located below a DEP facility in High Falls known as the Rondout Drainage Chamber, which was built in the 1910s at the same time as the aqueduct. The drainage chamber is located at the surface about 475 feet above the Catskill Aqueduct. It was designed to empty this portion of the aqueduct by opening a valve, allowing the aqueduct water to rise to the surface and flow into the nearby Rondout Creek. The chamber's original design also included provisions for pumping the last of the water from the tunnel into the creek.

The leak at this site is coming from around the valve itself, which is also 475 feet below ground. DEP believes that stress over time has caused some elements associated with the valve to deteriorate or lose function, allowing leakage through or around the valve. As a result, water at this site is steadily coming to the surface, through a culvert connected to the chamber, and into the Rondout Creek. While the exact amount of leakage is unknown, DEP estimates it is roughly 3 million gallons per day. (For perspective, gauge data shows the mean flow of the Rondout Creek at Rosendale is more than 175 million gallons per day.)

DEP plans to provide a temporary repair for this leak when the Catskill Aqueduct is shut down for 10-weeks in the fall of each year from 2018-2020. Those shutdowns were already planned as part of the Catskill Aqueduct Repair and Rehabilitation project, which will remove biofilm from inside the aqueduct and replace other century-old valves connected to the aqueduct. During one of those years, the valve below the Rondout Drainage Chamber will be removed and the pipe it's connected to will be sealed with a specially manufactured plug. Because the Rondout Pressure Tunnel cannot be drained, this work will be performed by a trained diver in an atmospheric diving suit.

In addition to the drainage chamber, DEP believes the Rondout Pressure Tunnel has developed leaks in at least two other locations. These much smaller leaks have created surface expressions on vacant portions of privately owned land in the vicinity of the tunnel.

Investigating additional leaks and designing a repair

Starting on Oct. 13, DEP will send a remote operated vehicle through the tunnel to pinpoint the other leaks. The operation will mark the first time anyone has seen the inside of the Rondout Pressure Tunnel since construction was completed in 1913. The vehicle will be connected to a long wire that will transmit high-definition video, acoustic information and other data back to a work trailer. Cameras and lights will be positioned around the entire circumference of the vehicle to gather a 360-degree view of the tunnel. In areas where a leak is suspected, food dye might be injected to help engineers see whether it leaves the tunnel through a crack, indicating a leak location.

Data gathered by the remote operated vehicle will take many months to analyze before engineers can draw accurate conclusions about leak locations or quantities.

Soon after, the U.S. Geological Survey (USGS) will also begin work to monitor the leaks and what impact they might have on local groundwater levels. This may be done through the installation of monitoring wells in the vicinity of the Rondout Pressure Tunnel.

Data gathered by the remote operated vehicle and USGS will inform the design of a permanent repair for the leaks. The repair work will likely be complex because the deep-rock tunnel always remains filled with water, is always under pressure, and no mechanism currently exists to pump it dry. A method for pumping the tunnel dry and entering it safely will likely need to be incorporated in plans to fix the leaks.

History of the Rondout Pressure Tunnel

Workers encountered especially difficult conditions and problematic geology when they constructed the Rondout Pressure Tunnel from 1910-1913. Generally, pressure tunnels were driven through dense bedrock and lined with thick concrete. But the underlying geology of the valley required workers to drive the Rondout Pressure Tunnel through poor-quality rock. Field notes from that time indicate “badly folded and crushed strata of High Falls shale and Binnewater sandstone” that allowed nearly 2 million gallons per day of groundwater to pour in on the workers as they pushed ahead. Historic records indicate that the inflow of water made it difficult for workers to lay concrete for the tunnel lining.

In fact, the original Rondout Pressure Tunnel failed a hydrostatic test in 1912, before the Catskill Aqueduct was put into service, and cracks in the tunnel that year that allowed groundwater to flow in. Repairs were made by welding steel rings incased in concrete into the weak sections of the tunnel, providing additional support and reducing the amount of leakage. The current-day surface expressions are located in the vicinity of problematic areas that were recorded in historic records when New York City built the tunnel.

The Catskill Aqueduct

The Catskill Aqueduct is a 92-mile conduit that carries drinking water from Ashokan Reservoir in Ulster County to Hillview Reservoir in Yonkers, on the northern edge of the Bronx. The aqueduct conveys about 40 percent of New York City’s drinking water on an average day, and it can deliver a maximum of 590 million gallons per day. Historic records show the Catskill Aqueduct once had a maximum capacity of 660 million gallons per day.

To restore some of that capacity, DEP has initiated a project known as Catskill Repair and Rehabilitation (CAT R&R). As part of the project, workers will scrub biofilm off nearly 40 miles of the cut-and-cover aqueduct lining. Biofilm consists of a harmless, filamentous bacteria that feeds on naturally occurring iron and manganese in the aqueduct water. The biofilm creates friction inside the aqueduct, causing water to slow down and resulting in less water traveling through the aqueduct on a typical day. DEP expects to regain 40 million gallons of capacity in the Catskill Aqueduct by removing the biofilm alone. The CAT R&R project also includes the replacement of 36 century-old valves connected to the aqueduct, and repairs of minor cracks along its cut-and-cover sections.

The Catskill Aqueduct first delivered water to New York City on Dec. 27, 1915, starting with water for the Bronx only. The water that came from the Catskills, through the aqueduct, was key to allowing New York City to grow through the industrial and population booms that followed World War I. The Catskill Aqueduct is also the primary water source for several upstate communities, including High Falls, New Paltz, New Windsor, Cold Spring and Cortlandt, to name a few.

DEP manages New York City’s water supply, providing more than one billion gallons of high quality water each day to more than 9.5 million New Yorkers. This includes more than 70 upstate communities and institutions in Ulster, Orange, Putnam and Westchester counties who consume an average of 110 million total gallons of drinking water daily from New York City’s water supply system. This water comes from the Catskill, Delaware, and Croton watersheds that extend more than 125 miles from the City, and the system comprises 19 reservoirs, three controlled lakes, and numerous tunnels and aqueducts. DEP has nearly 6,000 employees, including almost 1,000 scientists, engineers, surveyors, watershed maintainers and other professionals in the upstate watershed. In addition to its $70 million payroll and $157 million in annual taxes paid in upstate counties, DEP has invested more than $1.7 billion in watershed protection programs—including partnership organizations such as the Catskill Watershed Corporation and the Watershed Agricultural Council—that support sustainable farming practices, environmentally sensitive economic development, and local economic opportunity. In addition, DEP has a robust capital program with nearly $14 billion in investments planned over the next 10 years that will

create up to 3,000 construction-related jobs per year. For more information, visit nyc.gov/dep, like us on Facebook, or follow us on Twitter.

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