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Working together to solve pipe rehab challenge

Norwich, CT city officials discovered an unusual problem involving 2,695 feet of 14-inch force main pipe in September 2019. The gritty materials pumped on a regular basis had worn away the bottom of the 45-year-old cast iron pipe. Over time, the pipe walls were breached by the materials, allowing an inflow of heavy amounts of groundwater when the system was not pressurized, affecting its overall capacity.



Given the location of the pipe along a steep rocky embankment on one side and in close proximity to active railroad tracks on the other side, it would have been a costly dig and replacement project. To add to the challenges of the situation, the deteriorated pipe lay buried just a few hundred feet from the Thames River.

The city of Norwich, CT contracted Michels Corporation to address the situation without the need for surface disruptions. Michels is an international infrastructure and energy contractor with significant experience using trenchless options for rehabilitating water and sewer mains.

Once under contract, Water Lining Program Manager Mark Lucas was called upon to design a pressure pipe glass-reinforced felt cured-in-place pipe (CIPP) liner. Working with the experts at Premier Pipe, Interplastic and North American Composites, they engineered two-glass-layer, 9 mm fully structural designed Tech-liners that would be installed to repair the worn pipe.

Norwich Public Utilities (NPU) designed and installed five access pits and removed the air relief valves prior to the Michels crew arrival. They also installed the relief bypass system which stretched the entire project length to 2,700 feet. The 12-inch HDPE SDR17 bypass system had to be partially buried to allow for crew and railroad access to the entire site. NPU provided railroad flaggers and their crews also manned and maintained the bypass system throughout the duration of the project. Funding for the program was supported fully by the Norwich Public Utilities.

The initial CCTV inspections by Michels crews indicated that infiltration from the groundwater was intense in a section that lay directly under the existing railroad tracks. It was determined that without stopping the inward flow, the possibility of the CIPP resin being contaminated or washed out was a concern. Digging and replacement of the leaking sections wasn't an option. The best solution was to stop the water with a repair method that could test and seal several long sections of 14-inch diameter pipe while under heavy infiltration at the same time.

The combination of Michels' commitment to innovation and the ingenuity of Logiball resulted in the design and manufacture of an extended 14-inch flexible packer specifically for this job. The Long Span Flexible Packer (LSFP) was custom built by Logiball using a special soft rubber skin to allow for the packer to seat against the deformed pipe walls with a 60-inch long void span in between the expanded ends. Three ports to permit pressurization were set within the void area. This allowed the crew to conduct air testing and sealing of the pipe using AV-100 acrylamide grout.

"The design was unique, as we had never made an LSFP for that pipe size. We had to go to the drawing board," said Marc Ancil, President of Logiball, Inc.

The LSFP had to be flexible enough to bend through confined spaces to get into the pipe and yet strong enough to take the full pulling force of 850 feet of grouting hoses, video cable and cameras.

The end caps were custom made to fit within the 14-inch pipe openings, allowing for a flow-through design and yet still providing enough space for the air and chemical hoses connections. Within three weeks, the packer had been designed, manufactured, tested and shipped onsite to the Michels crews.

The arrival of Michels pressure pipe lining and grouting crews in late January 2020 was greeted with cold weather. As overnight temperatures dropped to single digits, the early morning challenges included frozen hydrants, water mains and pits, ice on the steep embankment roads, and occasional snow.

"The crews worked hard to maintain the equipment overnight," said Project Manager Patrick Hale. "All of our equipment had to remain running overnight, from the boilers to the recycler vac truck to the grout rig; all of our trucks utilize water and had the potential to freeze."



Working from opposite sides of the pipe run, Michels lining crews installed pressure pipe from pits three and four while Michels grouting crews tested and sealed using the latitudinal flexible packer from pits one and two.

“The lining crew worked tirelessly throughout the night and into the early morning to install, cure and pressure test the liner,” Hale said.

Sealing at just one or two points in the pipe section would section would not prevent water migration. The decision to test and seal the entire length of pipe from pit one to pit two was made based on the ability of ground water to travel throughout the full length of the pipe section in the pipe trench. Approximately 150 air pressure tests were performed in the 750-foot section of pipe. Upon failure of the air test, AV-100 acrylamide grout was pumped through the open segment of pipe to the exterior of the pipe. After the chemical gelled, a second air test was performed to assure the pipe was sealed. After the grouting of the mainline section was completed, the fourth and final segment of the CIPP pressure liners was installed, cured and tested. The newly CIPP-lined force main was then handed back over to the Norwich Public Utilities.

NPU reinstalled the blowoff valves, tied in the segments of line, performed site restoration, recommissioned the line and removed the bypass. The success of this job was only achieved by a collaborative effort of the Norwich Public Utilities, the engineering consultants at Jacobs, the lining suppliers and Michels Corporation.

John Manijak is Director of Training and Technical Support Services for Michels pipe rehabilitation operation.

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