UV CIPP RENEWS STORMWATER DRAIN AFTER OTHERS FAIL

PPM PROGRESSIVE PIPELINE MANAGEMENT
THE INFRASTRUCTURE RENEWAL SPECIALISTS

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After other methods failed, UV Cured-In-Place-Pipe (CIPP) proved an ideal solution to rehabilitate a leaking 36-inch storm drain under a heavily trafficked road at a manufacturing facility in New Jersey.

Project: 36-inch Stormwater Drain Renewal
Location: Middlesex County, New Jersey
Length: 70 feet
Client: Industrial Manufacturer
Contractor: Progressive Pipeline Management (PPM)
Method: UV Cured-in-Place-Pipe

In Middlesex County, New Jersey, a manufacturer had widened a roadway on its facility grounds to accommodate increased loading and traffic brought on by a plant expansion. Although the 36-inch storm drainpipe running under the roadway had been built with reinforced concrete pipe (RCP), the expansion material used was corrugated metal (CM). Over time, the joints between the CM and RCP weakened. When a major hurricane in 2022 created a stormwater surge of 15 feet, the joint seals and the pipe connections to the culvert at the inverts failed. Bottom line, the storm caused irreversible damage at the connections and at the culvert. Unwanted infiltration and sediment were leaking into and out of the end of the 36-inch pipe into the storm water system.

To protect the groundwater from unwanted sediment, the property owner needed to strengthen the 36-inch stormwater drain and remediate the unwanted infiltration that was straining the township's stormwater system. Their aim was to avoid tearing up the road to replace the pipe. Replacing the 70-foot length of pipe would have required a costly excavation and caused weeks of detours in and out of the facility. Delays would have impacted production at the plant.

Interestingly, the leaking stormwater drainpipe had been lined a few years prior. A 1-inch geopolymer liner had been installed in the storm drain by a different contractor. The thickness of the liner reduced the diameter of the 36-inch drainpipe and restricted flow-through capacity. Over time, and with changes in temperature and continuous heavy load conditions, the material started to weaken, contract, and shift, creating gaps between the host pipe and the liner. After the storm surge of 2022, chunks of the geopolymer liner were found floating in the culvert and the groundwater. It was determined that the previously lined infiltration points were leaking contaminants again.

Progressive Pipeline Management (PPM) was brought in to inspect the 70 feet of the 36-inch stormwater pipe and then identify an efficient and permanent way to strengthen the pipe to prevent further leakage without replacing the pipe. Any solution had to withstand the heavy weight loads and stop the previously lined stormwater pipe from leaking.

FIBERGLASS: THE CADILLAC OF MATERIAL FOR STRUCTURAL RENEWAL

PPM proposed a reinforced fiberglass, structurally sound, cured-in-place-pipe (CIPP) liner to be installed through the entire length of the 70-foot stormwater line. Reinforced fiberglass was proven to be strong enough to withstand the heavy traffic loads on the road because of its strength compared to other industry liner materials, without significant loss of flow or throughput. It is thinner (5.1mm) than other comparable geopolymer liners and is not susceptible to creeping over time from changes in temperature. The CIPP process uses a fiberglass liner mixed with a custom resin that is applied to the liner and cured with ultraviolet (UV) lights. Once cured, the fiberglass liner and host pipe would maintain shape and strength against the host pipe without any gaps. The cured liner has been tested for industry standards of 50 years of service life within the host pipe of reinforced concrete and corrugated metal.

> **"IN MOST INSTALLATIONS CIPP DOES NOT REQUIRE EXCAVATIONS."**

DESIGN & CALCULATIONS

Before the project was awarded, testing submittals and design calculations were required to confirm the CIPP could withstand the heavy loads it would be subjected to as well as flood risk. Depth of the pipe, HS-20 loading and DOT Highway and Safety Vehicular Loading were addressed by the design. Water levels, various types of storm and rain events, and propensity to flooding also were considered. Engineering calculations were done to determine the thickness requirement for the UV CIPP material used. The exact material to be used for the project was tested by an independent lab to confirm that it complied with the design specs.

Throughout the project design and execution, PPM worked with multiple stakeholders, decision makers and inspectors. Middlesex County officials had to approve the recommended solutions and submittals along with the manufacturing client.

Once approved, the UV CIPP project took just two days to execute. On Day One, PPM mobilized and prepared the pipeline. On Day Two, PPM prepped, placed, and cured the liner. As is true in most installations, CIPP does not require excavations. Only a small working area was needed for the open-ended culvert rehabilitation.

DAY ONE: CLEAN & PREPARE THE PIPE

The first step was to flush the line clean using a water propelled JetVac system. A powerful pressure nozzle cleared the pipe completely and pulled out any debris. Then, PPM's crew conducted a CCTV inspection of the cleaned stormwater drain. There was significant evidence of structural infiltration points; the corrugated metal pipe had corroded in many locations. In some areas, portions of the liner and host pipe were missing. The deteriorated corrugated metal voids were filled with a hydrophilic seal to reduce any annular space and future inflow & infiltration (I&I) leaks. Confined space entry procedures were followed when the crew entered the 36-inch pipe to fill the rotted voids.

The UV CIPP liner was dragged into place inside the drainpipe using rollers and a winch cable

The CCTV inspection confirmed the pipe was clear and ready for lining.

DAY TWO: LINING & CURING

After inspecting the previous day's void repairs and confirming they were satisfactory, the PPM crew installed a protective layer of sliding foil plastic inside

The end gate (blue) had a port on the side for pressurizing with compressed air to inflate the liner. The cable attached was used to pull the liner into place

> **"REINFORCED FIBERGLASS WAS PROVEN TO BE STRONG ENOUGH TO WITHSTAND THE HEAVY TRAFFIC LOADS ."**

the bottom of the pipe to prevent the CIPP liner from being damaged or ripped by the rotted corrugated metal during installation.

The heavy liner, already prepared for curing, had to be moved into place inside the pipe. A system of rollers with a winch cable was attached to the liner. Using the winch and cable, PPM pulled the liner into place through the 70-foot length of pipe.

The next step was to create a seal at the open ends of the line, so that compressed air could be used to inflate the UV CIPP liner. End gate fittings were attached at the two open ends of the uncured RFG material, creating a temporary seal at both endpoints. Using compressed air, the liner was inflated and pressed up against the host pipe's inner surface to create a watertight seal. This held the liner in place for curing.

Using a sluice at the end gate, the light chain with UV light bulbs was inserted inside the 36-inch liner. As each 1000-Watt UV light bulb ignited, the chemical reaction was initiated that transformed the soft, uncured fiberglass material that was coated with custom resin into a hard, bonded liner. The light chain specially designed for large diameter pipes acted like a series of train cars. Every 10 seconds one bulb was lit, until all 8 bulbs were ignited. Approximately 2.5 feet of the liner was cured per minute. The light chain was pulled through the 70 feet of the pipe at a mechanically regulated speed. Computer readings were recorded every 10 seconds and the light chain pulled back to where it was originally inserted. Curing was completed in less than an hour.

A significant advantage of UV fiberglass CIPP is that the process for curing is quick and simply done using compressed air. Felt and other liners use a styrene-based epoxy that is cured by introducing water or steam into the pipe, which then must be flushed. Water that encounters the liner, chemicals, and its surrounding fittings would have had to be treated and properly disposed. This would have added time, risk, and costs to the project.

After curing, the light chain was removed and the ends of the excess pieces of liner were cut off. A final step sealed the ends.

The light chain was pushed and pulled in a timed sequence to cure the inflated liner to the host pipe

Using confined space entry, the final cured liner was entered to re-instate the center manhole lateral connection

END SEALS TO FILL THE ANNULAR SPACE

Due to the deteriorated corrugated metal, the client was concerned about annular space forming at the ends over time. A hydrophilic ring-shaped gasket was installed between the outside of the pipe liner and the inside of the pipe at each end. End seals and grout filled in the annular space at the corroded sag points to prevent future infiltration into the system between the liner and the host pipe.

A final CCTV inspection showed the internal structure of the new liner to be clean, smooth, and flush with the host pipe.

After the CIPP was installed and cured, the crew had to open a manhole inside a channel to reinstate a lateral that took on stormwater flow. The lateral flowed into the stormwater drain system. This was done in collaboration with the municipality, as the manhole was owned by the township. A right-angle grinder was used to cut out the material.

LARGE EQUIPMENT & DIFFICULT TERRAIN

There were many challenges due to the location of the 36-inch pipe and culvert. The sloped sides of the culvert were lined with a special material that had sealers underneath it to prevent water from being absorbed into the ground. Due to the sloping terrain of the culvert and channel, there was no ready access for the necessary equipment at the exact location of the stormwater drain. The set-up and installation procedure had to be engineered to transport the liner and equipment down into the culvert with a steep grade on both sides. PPM's equipment was set up 25 feet away from the drain opening.

Before lining, the heavy liner had to be rolled into position at the opening of the drain without dragging or damaging it. A roller system was constructed and attached to a tail gate. Once the liner was situated at the opening, it was pulled through the 36-inch drain by a winch.

Confined space procedures were carefully followed when crew members were inside the pipe and later in the manhole. OSHA and HAZWOPER training certifications were required by the client for all the site personnel. All client and company health & safety and large equipment operator requirements were met.

RESULTS

After curing and the ends were finished, a sample of the cured liner was submitted for testing by a 3rd party to ensure it met design specifications. A second sample of the liner was provided to the client and the municipality to test the thickness and integrity.

Post lining testing ensured that the thickness, material, and curing process were done to specifications without any faults.

The UV CIPP technology selected was proven to be stronger and more sustainable that other liners. Additional testing and inspections confirmed to all parties that unwanted infiltration was not detected, and the new liner was structurally sound.

About Progressive Pipeline Management:

PPM is a full-service contractor and team of highly skilled infrastructure renewal specialists. For over twenty-one years, PPM has been improving the safety and longevity of pipeline infrastructure. PPM has a broad range of experience with underground infrastructure remediation and expertise with solutions for buildings, sewage, stormwater systems and utility pipelines. PPM is the exclusive licensee in North America for the Starline® Cured-in-place-lining technology. The team has specialized expertise including gas pipeline rehabilitation, restoration of damaged or leaking infrastructure, PIPES ACT compliance, facilities pipe renewal, and site services.

ABOUT THE AUTHOR:

PPM PROGRESSIVE PIPELINE MANAGEMENT
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Thomas Nestoras
is the PPM Sr. Vice President of Operations, and has been specializing in innovative infrastructure renewal for over a decade. Tom has extensive knowledge of all phases of construction site management. His career in construction started from the ground up, giving him a unique perspective on the many facets of project management and diverse equipment used to recondition pipelines. From "job walk" assessments of projects to handing the finished product back to the client, Thomas demonstrates excellence in project management. He is constantly looking for the most effective process to get projects completed in a timely and cost-efficient way. Thomas is an integral part of keeping up with new innovations at PPM which often involve new technologies and installation processes.