CASE STUDY

A Trenchless Rehabilitation Milestone – Fusible PVC Slipling in Peoria

Sliplined Fusible PVC force main to provide a long-term solution in the water reclamation process for the city of Peoria.

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Introduction

The city of Peoria (city) is making great strides towards treating wastewater for direct reuse and aquifer recharge as part of their sustainability efforts and water conservation. During the reclamation process, Waste Activated Sludge (WAS) is removed from the process to keep the treatment of the wastewater in balance. Initially the city's Beardsley Road Wastewater Reclamation Facility (BWRF) used an 8-inch ductile iron pipe (DIP) force main to remove the WAS from the reclamation process and discharge into a manhole more than two miles away, where it then flowed by way of a gravity sewer line more than 10 miles to the Butler Drive Water Reclamation Facility.

Original construction of the 13,463-foot long WAS pipe dates to March of 1999. Over time, corrosion of force main pipelines can occur due to the interaction between the ductile iron material and the composition of the WAS. The city had experienced failure in other DIP and felt it necessary to assess the condition of this force main to determine if rehabilitation or replacement was needed.

Method

The city contracted Dibble to provide an assessment of the force main and offer viable solutions. The force main was evaluated along its alignment by excavating and exposing four locations to perform visual and destructive testing on the DIP material.

DIP sewer force mains have a higher probability of corrosion due to entrapped air in the pipeline. The entrapped air leads to oxidation of hydrogen-sulfide (H2S) gas into sulfuric acid, which deteriorates the cement liner and leads to corrosion of the ductile iron.

Force Main Details and Project Summary	
Project:	6-inch Fusible PVC Force Main Sliplining Project
Location:	Peoria, Arizona
Length and Pipe Size:	13,463 LF 6-inch Fusible PVC pipe
Market:	Trenchless Technology
Installation Method:	Sliplining
Owner:	City of Peoria
Engineer:	Dibble
Contractor:	Achen-Gardner
Distributor:	Underground Solutions
Delivery Method:	Job-Order-Contract (JOC)

Based on the visual observations, field measurements, and testing of the excavated sections, Dibble discovered corrosion of the force main and serious deterioration, indicating the need for rehabilitation or replacement. This force main is the only mechanism for disposal of the WAS from the BWRF, making it imperative that the pipe remain in service.

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Section of Severely Corroded Pipe

Dibble presented multiple installation methods to the city, including open cut installation of a new pipe, trenchless rehabilitation, Cured-In-Place-Pipe, or slip lining new pipe material. The city consulted with one of their on-call contractors, Achen-Gardner, with whom they had a Job Order Contract (JOC) agreement with, specifically for this type of project, Wet Utility Pipeline Projects. Achen-Gardner assisted the city during the replacement/rehabilitation method evaluation, and during the pre-construction and construction activities for the project. Dibble recommended the force main undergo rehabilitation within one year, utilizing a non-metallic material, to ensure the WAS discharge service remained uninterrupted.

Plan of Action

Following discussion as a team, the city, Dibble, and Achen-Gardner determined trenchless construction to be the most viable option. Due to the length of the force main, at 13,886-feet, and the fact that 95% of the pipe alignment resided within a major five-lane arterial street surrounded by residential neighborhoods, businesses, parks, and an elementary school, the sliplining approach was the most cost effective. The sliplining method allowed for long segments of the rehabilitation material to be pulled in (up to 2,500 feet), which reduced the number of access pits and minimized the disturbance to the traveling public. Another advantage to the sliplining method was the ability to strategically locate the access pits for the installation of the 2,500-foot section of pipe, decreasing the excavation, backfill, and asphalt replacement typically associated with open cut installation.

Sliplining is one of the oldest methods of trenchless rehabilitation. It involves pulling or pushing a new pipe into an existing pipe.

The team considered three materials for the sliplining method, thermoplastic high-density polyethylene (HDPE), fusible polyvinyl chloride (PVC), and a compressed fit HDPE liner. Fusible PVC was the prime candidate for the sliplining method, due to the cost savings of material and the ease of fusion it provided compared to HDPE.

Installation

Working as a team, the city, Dibble, and Achen-Gardner developed construction plans that met the project schedule. Dibble was contracted to provide the construction administration and inspection services for the construction portion of the project. Project funding was set to be dispersed over two fiscal years to accommodate the budget the city had available for repair in fiscal year (FY) 18 and the funding that would be available in FY19. The construction schedule was also set to occur from the end of FY18 and roll into FY19 to allow for the provided budget. The project schedule accounted for a portion of the rehabilitation that needed to be completed during the summer, to eliminate the impact on a school near the force main alignment. The fusible PVC slipline project began just after Memorial Day, on May 27, 2019.

To maintain normal plant operations, the existing pumps were connected to a temporary 8-inch pipe, creating a bypass, and allowing the flow of the WAS to remain uninterrupted. Utilizing the existing pumps provided cost savings associated with typical bypass pumps.

Underground Solutions began fusing the fusible PVC at street level in a closed lane. Traffic lanes were reduced to accommodate open pits to allow plenty of workspace and ensure safety for the public and the workers on-site. As portions of the project were completed, lanes reopened to traffic.

A 5-ton cable winch pulled the fusible PVC into the host pipe, with 13 pulls total. Most of the pipe section pulls were over 1,000 feet in length, with

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the longest pull length at 2,300 feet. Dibble recommended using push-on PVC fittings with restrain harnesses instead of typical ductile iron fittings due to corrosion concerns.

Installation Process

The force main at street level finished in early September 2019. Installation of smaller pumps accommodated the reduction in the force main diameter. After completion, Dibble conducted a pressure test of 130 psi, held for two hours. The resulting success of this pressure test confirmed that the pipe would meet or exceed operating pressure requirements. Exposed ends of the existing pipe, where the fusible PVC was either pulled or received, was then sealed, prior to backfill and paving, to prevent infiltration into the annular space between the existing pipe and the new pipe. This portion of the project concluded approximately two months ahead of schedule.

Lessons Learned

During the pipe cleaning process, which is the first step in the rehabilitation process, the team discovered that the length of pipe to be cleaned needed to be considered. Although long sections of pipe are pulled in with the sliplining method (which reduces the number of excavation pits needed), during the cleaning process, the team needed additional excavation pits allow access for the pipe cleaning equipment.

Another important item to consider during the rehabilitation process is the accuracy of the as-built documentation. During construction, the team discovered that proper as-builts conditions were not noted on the existing 8-inch DIP plans. Fortunately, on this project, the actual conditions did not hinder the installation of the pipe. Dibble properly noted the as-built conditions during the close-out phase of this project to prevent this inaccuracy in the future.

Conclusion

Fusible PVC is used nationwide, with more than 12 million feet in service, spread between 12,000 projects. In Arizona there are approximately 15 projects using this material.

This project was a benchmark for trenchless rehabilitation in Arizona, as it is the longest fusible PVC pipe installed to date.

Fusible PVC is a new product in the trenchless application for Dibble, Achen-Gardner, and the city of Peoria. The team met the project objectives, providing a reliable, long-term solution for the city and the transfer of the WAS to the next location in the reclamation process. Due to the trenchless application used, sliplining, the project finished ahead of schedule with minimal construction impact to the traveling public.

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