



# LEADERS IN INNOVATION:

## MIAMI-DADE'S ASSET MANAGEMENT PROGRAM

**M**iami-Dade Water & Sewer Department (MDWASD) operates one of the largest public utilities in the United States. MDWASD services the state's highest population, nearly 2.3 million people per day. The customer base consists of approximately 422,000 retail customers and 15 municipal wholesale customers, along with unincorporated areas of Miami-Dade County.

MDWASD's service area is 400 square miles with 7,918 miles of water mains ranging in size from 2 to 120 in. in diameter. For large transmission mains, MDWASD uses predominantly prestressed concrete cylinder pipe (PCCP), and has over 100 miles of PCCP 48 in. and larger. Much of the PCCP is located in densely populated areas, some running under major roadways.

After a series of high profile failures in 2010 and 2011, MDWASD began a renewed focus in pipeline management and developed a comprehensive asset management program for its large diameter pipeline system to minimize disruptions to residents.

Water delivery can often be a costly and complex service to provide. MD-

WASD had to develop a program that balances upgrading to a sustainable system while still serving the region's expanding base of customers.

MDWASD focused on becoming more proactive in the implementation of pipeline infrastructure upgrades. With some of the pipes being more than 80 years old, MDWASD understood that these older pipes have a higher risk of failure and would cause more service loss and emergency repairs if not properly addressed.

"The rising number of our urban customers makes reliable operation of our pipeline systems a big priority. We have to minimize outages and plan ahead when we do have to have an outage," explained Luis Aguiar, Assistant Director of Water Operations at MDWASD.

In order to ensure reliable delivery to residents and to manage the financial impact, MDWASD established the Infrastructure Assessment and Rehabilitation Program (IAARP). The program consists of scheduled inspections of the pipeline inventory on a rotating basis.

As part of IAARP, MDWASD adopted targeted inspection and replacement specifically for PCCP - considered a best

practice for the industry. When a large enough number of prestressing wires break on a given segment of PCCP, there is a localized loss of prestress on the pipe that compromises the segment's structural integrity and needs to be addressed. Utilizing inspection methods that pinpoint which pipe segments have broken wires allows MDWASD pipeline systems to be repaired or replaced before pipeline integrity issues cause unscheduled and costly shutdowns.

After an inspection of a given pipeline run has been completed, MDWASD analyzes the collected data. A failure risk analysis is developed, which involves the development of failure risk curves that take into account the specific design details of the PCCP segments (prestressing wire pitch and spacing, cylinder thickness, concrete core thickness, etc.) as well as internal and external loads acting on the pipe. Then, by using these failure risk curves in conjunction with known operating and transient pressures, soil conditions and pipe configuration, a targeted number of pipelines can be selected for rehabilitation. Following the determination of which pipes require re-

Comprised of FRP and continuously wound high-strength steel wire reinforcement, the hybrid FRP system is applicable for trenchless repair and renewal for pipes that are 36-in. in diameter and greater.

habilitation, the decision-making process for how to address repairs is completed by MDWASD.

The location of many of MDWASD's pipelines, underneath or directly adjacent to major roadways, provides many substantial advantages for trenchless rehabilitation technologies over traditional dig-and-replace or other construction methods that require excavation. MDWASD's mission is to address the identified high-risk pipeline segments with targeted structural repairs instead of having to dig up the streets.

To increase the quality and reliability of its water system, MDWASD invests in the utilization of the most cutting-edge technologies to improve the efficiency of repairs and extend the life of infrastructure. MDWASD has used high-strength, fiber-reinforced polymer (FRP) materials for the past several years as a method to provide structural upgrades to specific pipe segments identified during inspections.

Recently, MDWASD extended its commitment to innovation by implementing a hybrid FRP solution during a pipeline upgrade project located under a 3.5-mile stretch in the Miami-Dade area.

Structural Group Companies, Structural Technologies and Structural, provide MDWASD with engineered product solutions and specialty contracting services, respectively, for carbon fiber upgrades of pipeline segments. Following a repair options analysis in 2014, MDWASD elected to move forward with a pilot project utilizing Structural Technologies' StrongPIPE hybrid FRP system for three segments of 54-in. PCCP to evaluate the system for future upgrades.

StrongPIPE hybrid FRP is a composite solution developed to rehabilitate extended runs of large-diameter pipe as an alternative to other methods such as sliplining. Comprised of FRP and continuously wound high-strength steel wire reinforcement, the hybrid

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FRP system is applicable for trenchless repair and renewal for pipes that are 36-in. in diameter and greater. The system can be used on all types of pipe materials, including PCCP, RCP, metallic and ductile pipe.

The hybrid FRP system is fully structural, custom designed to resist all internal pressures and external loading requirements. Beyond the benefits of being trenchless, one of the most significant benefits to owners when contrasting it with sliplining is it minimizes section loss. With a typical thickness of 0.5 to 1 in., the system can be installed with minimal impact on flow levels. With rapid installation through existing access ways, and seamless transition through bends using system materials, the hybrid FRP system allows owners of large-diameter pipelines to extend, or even double, the life cycle of their critical pipeline assets with minimal downtime and impact to operations.

The pilot installation took place in summer 2014 and began with mobilization, dewatering of the pipeline and setup of appropriate safety equipment for manned entry into the pipeline segments. Installation crews first completed surface preparation to create the appropriate surface profile for bonding of the FRP system, the first component of the system. Following this, a high-strength steel wire is placed utilizing automated equipment that feeds the wire from a



↑ A high-strength steel wire is placed utilizing automated equipment that feeds the wire from a truck unit positioned outside the access way.

truck unit positioned outside the access way. Following wire installation, the steel is encapsulated in epoxy putty and the final layer of FRP is installed to meet design requirements. A top coating is then added for wear and/or chemical resistance if needed.

The hybrid FRP system was successfully installed and restored full functional capacity of MDWASD's high-risk pipeline segments by increasing the structural capacity.

MDWASD draws and disperses approximately 300 mgd through its pipeline system for its customers. Through the development and implementation IAARP, MDWASD effectively manages its inventory of pipelines through a combination of precision inspections, targeted replacements, and utilizes innovative solutions. As a result, MDWASD ensures pipeline reliability, manages limited resources, and improves the life of residents.

"Our goal at Miami-Dade is to identify and use the most effective systems possible to maintain consistent delivery of water to our citizens," Aguiar added.

With continued prioritization of inspection and rehabilitation efforts for large-diameter water mains, along with a desire to use the leading technologies to extend the life of its pipeline assets, MDWASD will continue to be one of the most proactive water agencies in the United States.

**This article was contributed by Structural Technologies LLC.**



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