Rehabilitation of Water Mains

AWWA MANUAL M28

Second Edition

American Water Works Association

MANUAL OF WATER SUPPLY PRACTICES—M28, Second Edition

Rehabilitation of Water Mains

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Contents

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Figures

Tables

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Foreword

This manual was written for water system designers, engineers, operators, and managers who need a reference guide for analyzing various water main rehabilitation options. This manual summarizes current information about water main rehabilitation technologies used in the United States and Europe today. All specified technologies must have NSF61 (National Sanitary Foundation) approval for components that come into contact with potable water.

While there are many emerging technologies that show promise for water main rehabilitation, this manual specifically addresses those technologies that 1) can be employed by a water utility to successfully rehabilitate water mains and 2) have a proven track record within the water industry. No attempt was made to evaluate one method of water main rehabilitation over another, and no attempt was made to evaluate relative costs between competing systems. It remains for the utility to decide which system will best suit a specific project, taking into account a variety of factors, including the cost of the process, the social disruption, the need to increase or maintain existing water main diameter, and so forth.

According to a US Environmental Protection Agency needs assessment survey, approximately $80 billion may be required to improve transmission and distribution water mains to meet clean water requirements over the next decade. In the past this was accomplished by installing new facilities to replace aging infrastructure. With the exception of cleaning and cement–mortar-lining (which has been in use since the 1930s), the only option available to water utilities was costly dig-and-replace techniques. This manual describes viable, less costly options that have the potential to be less disruptive to the public, while providing the utility with a long-term solution to their water main needs.

The first edition of American Water Works Association (AWWA) Manual M28 was written by the AWWA Cleaning and Lining Committee. The second edition was written by the same committee; however, because of changes in the water main rehabilitation industry, the name of the committee was changed to the AWWA Water Main Rehabilitation Committee.

The Chairman of the committee, Michael E. Grahek, would like to thank the contributing authors responsible for new material supplied to expand the current manual into an up-to-date water main rehabilitation manual, specifically, Dr. John Heavens, Bernie Monette, Gary Zinn, Darrin Thomas, Benedict Ebner, Michael Landes, Daniel Moore, John Dugan, and George Mallakis.

In addition to those who contributed directly, the balance of the committee participated by reviewing and approving materials submitted for inclusion in the manual, adhering to the highest ethical standards, and keeping the needs of the

water-using public at the forefront. The committee had the following members at the time:

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Chapter 1

Distribution System Performance Criteria

WATER QUALITY

The quality of treated drinking water may vary considerably, both from system to system and within a system, as a result of deterioration after it leaves the treatment plant and comes in contact with the interior of distribution system piping. Over time, changes in water chemistry can cause problems throughout the distribution system, ultimately affecting the quality of the water delivered to the end user.

The specific nature of distribution system water quality problems vary with water chemistry. However, the majority of these problems fall into three categories: sedimentation, encrustation, and fouling.

Sedimentation

Sedimentation is the process whereby solids settle out of water moving at low velocity in a main, reducing interior cross section and capacity. Source water pipelines or pipelines carrying improperly treated water can be subject to deposits of sand, silt, or organic materials. In extreme cases, sedimentation can also contribute to hydraulic problems, particularly at low points in the pipe.

Even slight overtreatment of water can result in posttreatment precipitation within the distribution system of deposits containing alum, lime, or calcium carbonate. A utility may promote controlled precipitation to lay down a thin layer (eggshell coating) of calcium carbonate for protection of the metallic pipeline interior. However, excessive or irregular deposits can easily occur, requiring cleaning of the distribution system.

Encrustation

Encrustation is a by-product of corrosion (tubercles) mixed with mineral deposits, such as iron, manganese, and carbonates. Before the 1960s, many iron pipes were