# Executive **Summary**

WATER ENVIRONMENT & REUSE FOUNDATION

# Synthesized knowledge on force main management practices

Asset Management of Force Main Infrastructure – Synthesis Report (U4R14a)

## The Central Issue

The difficult nature of inspecting force mains has led to reactive approaches to managing these assets. Along with the difficulty of access, there are limited technologies available for inspection. Additionally, inspections require the force main to be taken out of service – a major limitation. However, with advancements in inspection technologies, utilities are beginning to take a proactive approach to managing force main assets.

## Context and Background

Force mains are installed at critical points in the wastewater distribution system. The key elements that significantly influence the need to address the inspection, condition assessment, and renewal strategies of force mains are:

- Lack of sufficient redundancy.
- High consequence of failure.
- Accessibility of the force main.

These elements can be addressed through the selection of suitable inspection technologies. Yet, due to wide ranging defects observed in different force main materials, no single technology is able to provide effective useful data.

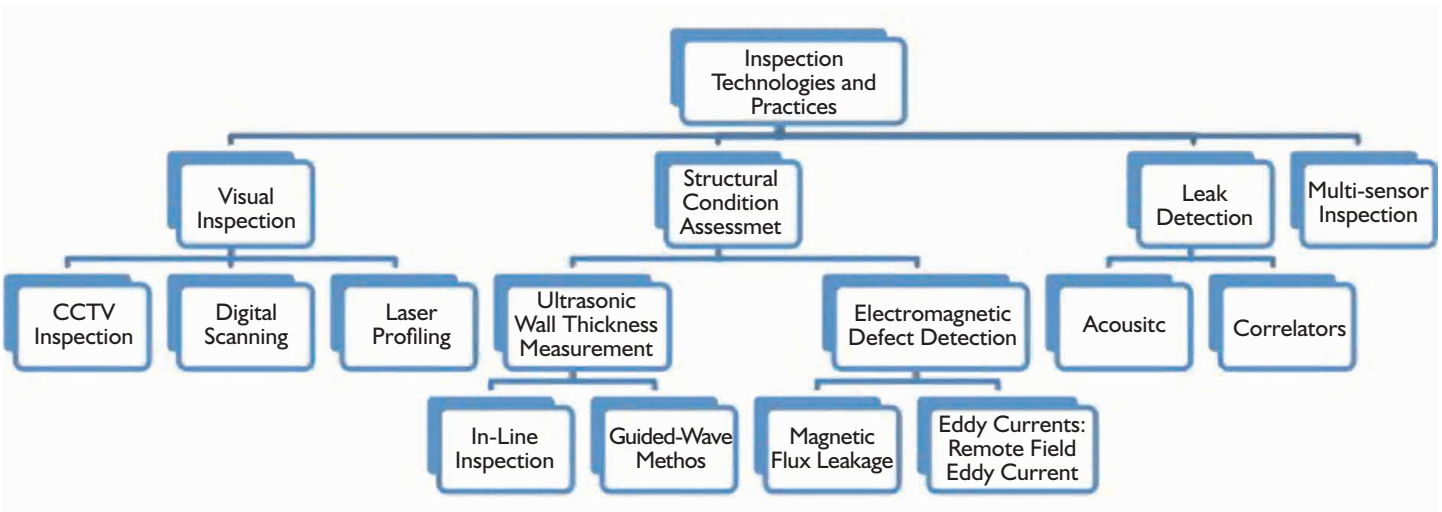
## Findings and Conclusions

Advanced asset management practices are beginning to be employed to manage force mains. This research synthesizes the current state of knowledge of inspection practices and technologies and renewal strategies from literature and practice reviews. The report also provides a comprehensive force main infrastructure asset management guideline. It describes the characteristics of force main networks and the causes of failures and examines utility inspection practices and technologies associated with force mains. It reviews the practices regarding the condition assessment and risk management for force mains, as well as the renewal practices related to the renewal of force mains.

## Management and Policy Implications

Because force mains can present a high business risk exposure to the utility, the management strategy for these assets must change. To cost effectively identify the defects, a force main investigation program can be developed to estimate the likelihood of failure, consequence of failure, and the remaining service life through condition assessment programs.

The gaps and limitations in the force main infrastructure asset management can be partially addressed by standardizing the utility asset management practices. A standardized defect index and grading scale should be established by the utilities. Performance index and prediction models can be combined with consequence of failure indices to establish the business risk exposure associated with assets for prioritization and renewal decisions.




*Various Inspection Technologies for Force Mains.*

## Related WE&RF Research

| Project Title | Research Focus |
|---|---|
| **Condition Assessment Strategies and Protocols for Water and Wastewater Utility Assets (03CTS20CO)** | Provides information on how to effectively use condition assessment tools and techniques to improve both long-term planning and day-to-day management of assets. The report is structured for two distinct audiences:<br>1) Utility planning managers who want to use cost-effective condition and performance assessment programs to support long-term planning decisions.<br>2) Engineering/maintenance managers that want to identify and understand the advantages and disadvantages of tools and techniques for measuring the condition and performance of utility assets to support daily maintenance and operation of assets. |
| **Inspection Guidelines for Wastewater Force Mains (04CTS06URa)** | Provides a set of inspection guidelines, for ferrous force mains which can be implemented by wastewater utilities in their condition assessment programs. |
| **A Practitioner's Guide to Economic Decision Making in Asset Management (SAM1R06b)** | Part I presents background concepts including drivers, approaches, decision support tools, and frameworks relevant to economic decision making in asset management and provides the basis for the guidance of Part II. Part II provides insights into the development of a decision support framework and methods such as strategic budget setting, changes in service levels, investment decisions, and benefit cost analyses. |
| **Predicting the Remaining Economic Life of Wastewater Pipes**<br><br>**Phase I: Development of Standard Data Structure to Support Wastewater Pipe Condition and Performance Prediction (SAM3R06)** | Presents information about wastewater pipe failure modes and mechanisms that can occur during design, manufacture, construction, operation and maintenance, and repair, rehabilitation, and replacement. Provides standard data structure and data collection methods that enable effective and systematic data collection and data storage as part of an asset management program and for analyzing the performance of wastewater pipe infrastructure systems. |
| **Phase II: Development of a Robust Wastewater Pipe Performance Index (SAM3R06a)** | Develops protocols and methods for predicting the remaining economic life of wastewater pipes. Includes an analysis of data from participating utilities and develops a robust wastewater pipe performance index that includes physical, operational, environmental, and other parameters for pipe segments and the entire pipe system. |

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