

MANAGING THE RISKS OF AGEING STEEL WATER MAINS – A REDCLIFFE CITY COUNCIL EXPERIENCE

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Abstract

The former Redcliffe City Council, now part of Moreton Bay Regional Council, secures over 70% of its water via the 24km long Petrie Bulk Supply Water Main, an ageing infrastructure asset that is now almost 50 years old and three quarters of the way through its estimated economic life.

Connell Wagner was commissioned by Redcliffe City Council to develop a life cycle maintenance management strategy for the Water Main. Innovative testing techniques were used to develop a profile of the active corrosion along the pipeline and provide a verifiable measure of the condition and performance of the asset.

As part of the consultancy, the consequences of failure of the main were also assessed, including direct, indirect and social costs to the community and other stakeholders. This directly influenced the final strategy adopted by Council.

Introduction

The Redcliffe City Council is on the northern outskirts of Brisbane. Seventy percent of the city's water supply is delivered through a 24 km steel water main ranging in size from 600 mm to 750 mm. In recent years the water main has shown signs of deterioration, with an increase in the number of failures causing concern. This prompted an investigation to determine the future maintenance and management requirements for the main. The Council were particularly sensitive to the mains condition as this is the city's core water supply line and is therefore an essential service for the Redcliffe community.

The Council engaged Connell Wagner to undertake an assessment of the current performance of the Petrie Main. Based on

Connell Wagner's recommendation this assessment was undertaken using non-intrusive testing by using an "over-the-line potential" survey. This provides a continuous reading of the electrical potential of the main and thus provides an indication of where corrosion is likely to be present and where the protective external coating has been damaged.

The advantages of this approach were that it allowed the entire length of the pipe to be surveyed at relatively low cost and it avoided the uncertainty associated with spot assessments. The unobtrusive testing technique also mitigated the potential damage to the pipe existing coatings during excavation, requiring expensive rewinding and recoating the exposed section of pipe, as

had been evidenced from a study of previous maintenance works.

The results of the survey indicated that Council, with a detailed preventative maintenance plan, can extend the life of the main up to 15 years beyond its design life. Connell Wagner worked with Redcliffe City Council to develop an action plan which will continue to monitor and maintain the main through to 2035 when demand is expected to exceed the pipelines capacity and further consideration would need to be given to augmentation or replacement of the line.

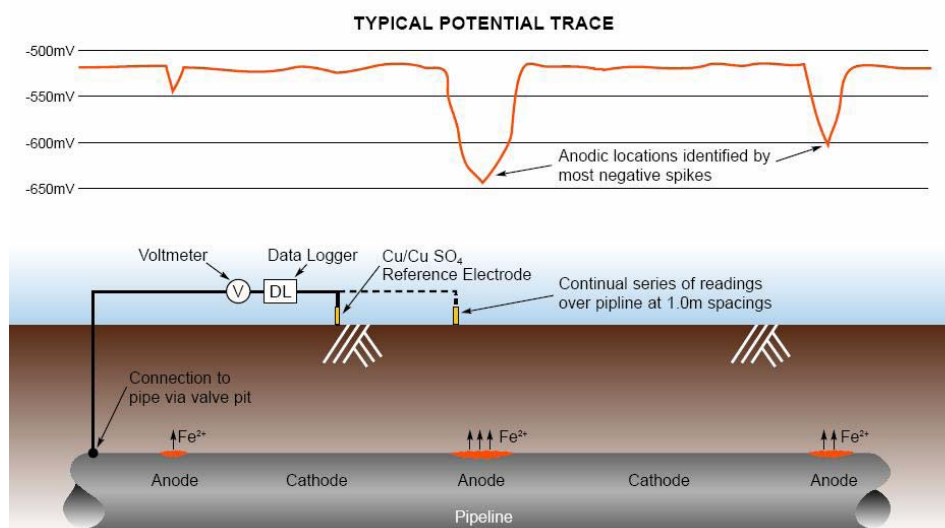
Project scope

The Petrie bulk supply water main is a critical component of Redcliffe's water supply infrastructure and, with a discernable increase in the occurrence of bursts or leaks, Council sought advice on the risk of the pipe deteriorating to a point where it becomes a maintenance liability, ultimately requiring earlier than expected replacement.

Council were keen to, within a restricted budget, gain a clear understanding of its current position and, with support from Connell Wagner, developed a methodology that would deliver the required outcomes.

The agreed approach was to utilise and report on the pipes condition, determine the pipes capacity to meet Redcliffe's needs into the future and to develop a model to provide cost effective management of the pipeline over its remaining economic life. The scope also included an analysis of the refurbishment and replacement options available with the ultimate deliverable being a life cycle analysis that would recommend the optimum time for replacement. In terms of the technology used for the insitu testing of the mains condition, the "over-the-line potential" survey method was adopted which is regarded in the industry as a cost effective method of providing a condition assessment of pipe coatings. The process is illustrated below.

Development of the maintenance and management strategy, and determination of the optimal timing for replacement took into consideration the "over-the-line potential" test results and historical maintenance and inspection reports. An analytical approach was used to determine the likely future performance of the pipeline.



The Over the Line Potential technique illustrated was used to measure the corrosion activity

Study findings

The testing carried out by Connell Wagner highlighted the extent of damage to the external coating, but more specifically provided a verifiable measure of the extent of active corrosion along the full length of the main. Testing was undertaken at one metre intervals along the length of the pipe which enabled areas of highest risk to be clearly identified. Seventy percent of the length of main surveyed was graded as having some active corrosion with 14% experiencing severe or significant corrosion activity.

Previous studies had identified that the cause of corrosion was through defects in the external coating, in particular splitting of the coating at the top of the pipe and wrinkled or delaminated coatings. The damage to the coated was likely to have been caused by settlement or compaction of the surrounding fill. Although previous studies had identified the coating damage, the extent of the damage could not be reliably assessed and excavation to expose the pipeline had proved costly and exposed the pipeline and coating to further risk of damage.



Defects in external coating

The widespread defects in the external protective coating, combined with the aggressive environment in which parts of the water main are located, is expected to provide significant corrosion problems in the long term unless some remedial or preventative action is taken.

Based on the findings of this study Redcliffe City Council considered a series of actions to better manage risk. Clear objectives were to extend the life of the main through a

maintenance programme that would generate the best value-for-money outcome for Council. Actions included:

- Design and installation of cathodic protection to extend the useful life of the asset
- Developing a set of operating procedures and guidelines to ensure the main was not subject to unnecessary surge or water hammer
- Carrying out a hydraulic review of the existing main to identify operational limits
- Repeating similar pipe testing on a five year cycle to be able to gauge the rate of deterioration of the pipeline and adjust the life cycle and maintenance plan as necessary
- Enhanced telemetry at strategic points within the network to monitor operating status and ensure the pipe is working within its safe limits
- Ensuring reservoir levels are maintained at a level that reduces the demand on the pipeline in peak use periods
- Developing a funding strategy to replace the pipeline, projected to occur in 2035.

Conclusion

Redcliffe City Council now has a detailed maintenance strategy for the Petrie bulk supply water main that will extend its life by up to 15 years and ensure its survival until its service capacity is reached. This has potentially deferred a substantial capital investment of up to \$12 million for 10 to 15 years through the use of contemporary condition auditing processes provided through Connell Wagner.

This has been a very favourable outcome for Council, which is now well aware of the variable condition of the main and the importance of developing and adopting a maintenance management strategy approach to preserving the life of high risk assets.

References

Nil

Author

 **Connell Wagner**

This project is an example of how the consultancy sector and local government can work together to better serve the community.