International No-Dig 2013
31st International Conference and Exhibition

Sydney, Australia
1–4 September 2013

Trenchless Watermain Renewals in Australia: Advancing the Possibilities

Ian Bateman
Interflow Pty Limited

ABSTRACT

Trenchless sewer renewal is now a vibrant mature industry in Australasia and in many regions of the world. There are now many standards and accepted methods for assessing the condition of the pipeline and then executing the renewal of all parts of the network with trenchless methods (manholes, pipeline, lateral connection, lateral pipe etc).

Watermain renewal is far less mature but the need for cost effective trenchless solutions is just as great. The number of kms and age of watermains is essentially the same as the sewer pipes and the incidences of pipe bursts and leaks are significant.

The principle reason that trenchless watermain renewal lags behind sewer pipe renewal is that the technology either does not exist or is not cost effective compared to traditional dig and relay methods. However, technology is advancing and the potential to have trenchless watermain renewals as widely used as in sewer is now foreseeable. This paper will present several initiatives that have been undertaken in the Australian market to advance the conversion from traditional methods to trenchless solutions.

1. Introduction

Up until the early 1990s, the most common method to renew a sewer was to excavate and replace the damaged sections of pipe. Until this time, trenchless solutions were either not commercially competitive or not existent.

Since this time, technology providers and contractors have developed products and methods that have seen trenchless systems largely replace the traditional excavation methods.

The journey over the last 20 years has been gradual. Trenchless lining systems such as spirally wound, CIPP and pipe bursting have been refined, improved and developed. The cost per metre of installation has continually reduced such that it is now almost universally cheaper to renew sewers by trenchless methods than by excavation. Additionally, we are also seeing that more and more of the network is being renewed. Manholes, lateral lines, lateral connection as well as culverts and stormwater assets are commonly being renewed using techniques developed over the last 20 years.

The growth in trenchless sewer renewals has also been geographical. It is no longer just performed in the major urban areas. In Australia and New Zealand most councils will have had some of their assets renewed by trenchless methods.

If current trends in the sewer renewal industry continue, it is likely that we will see trenchless pipe renewals expand and continue to develop such that asset owners get even more value in terms of cost, social amenity and environmental impact. This growth will bring the rate of renewal closer to the average rate of sewer pipeline degradation.

In the case of water pipe renewals, the situation is different. The number of kilometres of water pipelines is similar to the number of kilometres of sewer pipes (in Australia approximately 100,000kms). Both networks have a finite life and degrade over time. It is estimated that approximately 500km of both sewer and water mains are renewed each year. However, the rate of *trenchless* water pipe renewals is far below that of sewer pipe renewals. Water pipe renewals are commonly undertaken with the traditional excavate and replace method. This is similar to where the sewer pipe renewal market was 20 years ago.

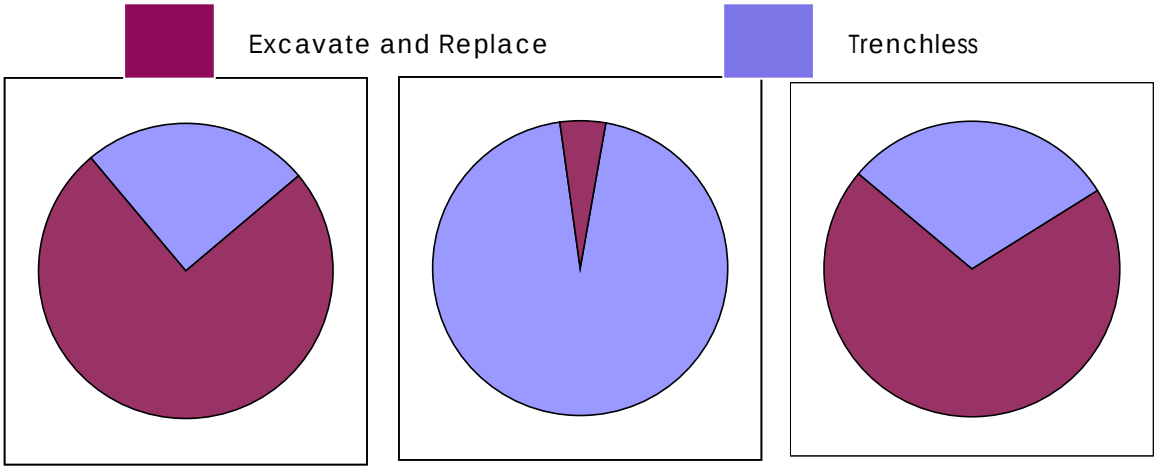


Figure 1: Representation of trenchless sewer and water renewals in Australia

Given the demand for water and sewer renewals is similar, why is the proportion of trenchless technology used in water main renewals significantly less than sewer and what steps are being taken to increase the volume of watermains renewed by trenchless methods?

2. Challenges Faced in Renewing Water Mains by Trenchless Methods

The dynamics of watermain renewal are quite different to sewers. Watermains are pressurised, sterile, of smaller diameter and are generally laid at shallower depth. Also, the consequence of being without water during a repair or renewal has a greater social impact.

If we look to how the trenchless sewer renewal market developed and draw a parallel to the trenchless watermain renewal market, we could expect that we will see the market grow as watermain renewals become

- More cost effective
- More trenchless
- Less disruptive

Furthermore, other drivers such as asset owners placing greater weighting on aspects such as environmental impact, social impact and safety will also contribute to growth of trenchless methods.

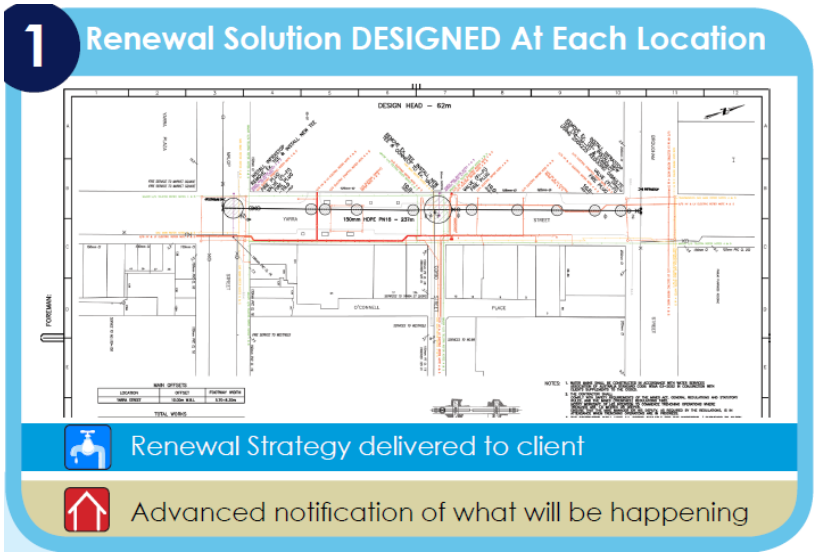
So where is the Australian market today?

There is an estimated 70-80km of *trenchless* water mains renewals per year and over 400km of dig and replace. The majority of the trenchless watermain renewals in Australasia are conducted using pipe bursting, die reduction or slip lining techniques and whilst the installation of the pipe is "trenchless" several of the associated processes require a local excavation (e.g. lateral reconnection), but in comparison to a complete open cut replacement the amount of excavation, disruption and site rectification is significantly reduced

3. Execution of a Trenchless Water Main Renewal Project

The technology and methods used in trenchless water main renewal continue to evolve. The following sections will outline the 6 key steps involved in a renewal and how they offer a benefit to the client over the traditional dig and replace method.

Step 1. Design



Before any work commences the optimum strategy for executing the renewal is determined. The objective is to work out how to minimize the impact on residents and the community in terms of water shut offs, installation of temporary service, traffic disruption etc. By analysing the network, significant benefits can be identified.

The optimum solution is determined by the installer and presented to the asset owner. The plan is then reviewed, adjusted if needed and then agreed. This forms the blueprint for the renewal work. The local residents are then informed.

Step 2. Temporary Services Are Installed

Having identified the residents that will be affected by the renewal, temporary water supply is connected to all residents. This ensures that 100% continuity of supply exists for the duration of the job. Temporary services are community friendly and include archways on the footpaths and ramps on all driveways.

Step 3 An Online Water Stop (Infrastop®)is Installed

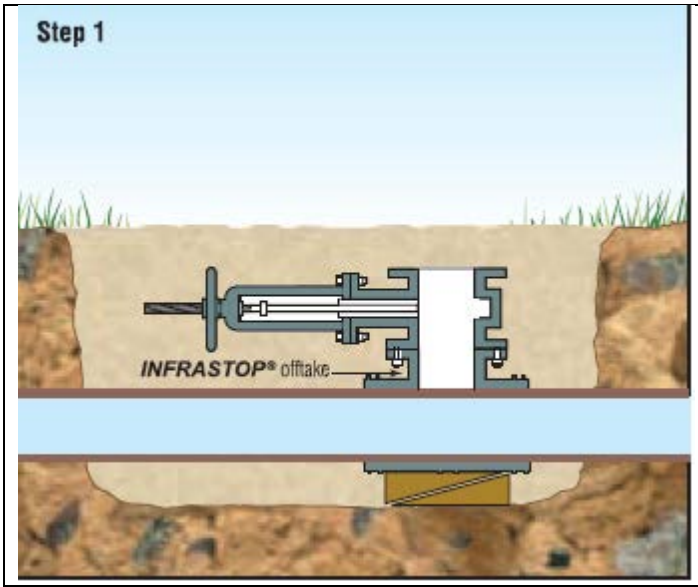
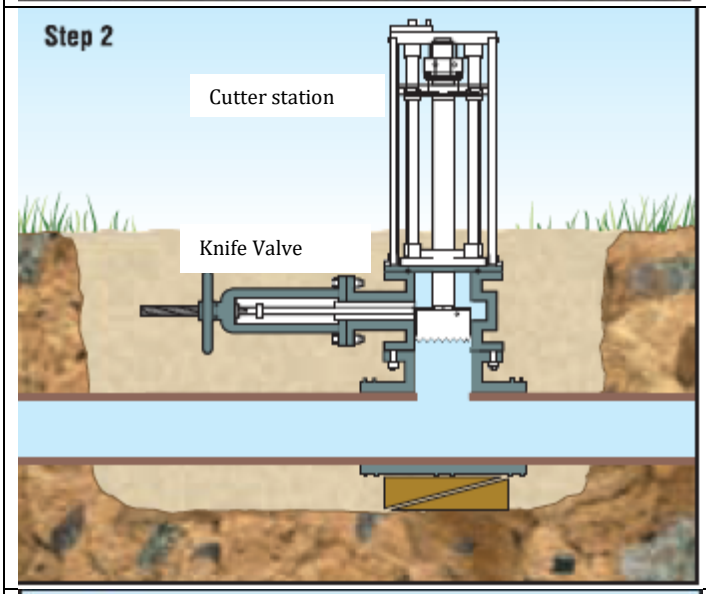
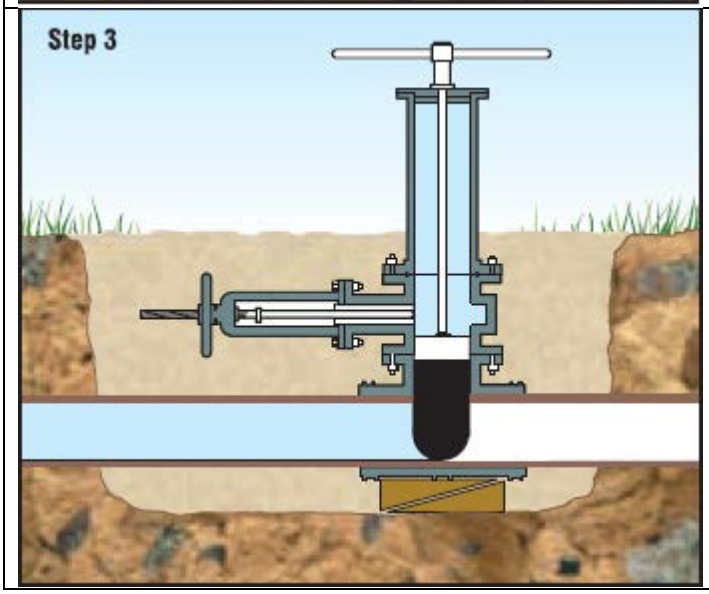
Traditionally, a water pipe would be capable of being isolated and taken out of service by shutting off the nearest shut of valve. This may impact several streets and can affect many dozens of residents. Figure 2 illustrates this. The shaded region shows the number of residents that would be affected by shutting of supply at the existing valve. Note the red line indicating the location of the water main to be renewed.

Figure 2: Residents affected by shutting of supply at existing valves

Clearly the potential for resident disruption is vast and since it is not feasible to take this number of residents off line for the duration of the water main renewal either temporary services would need to be provided to all of the residents in the shaded region or a shut off would be installed immediately upstream of the renewal activity. Installing such valves could only be done with the water supply shut off, so the residents in the shaded region would still be without water for at least the length of time it took to install the shut off valves – typically approximately 4 hours.

The Infrastop technology eliminates both the problems mentioned above. This patented shut-off valve is able to be installed immediately upstream (and downstream if needed) of the job with the water main still in service, hence causing zero interruption to the residents. When the Infrastop valve is shut, the water supply is diverted to the temporary water supply system and the residents are then assured of water for the entire duration of the renewal.

Infrastop® has proven to be fail safe. In over 10 years there have been no instances of equipment malfunction that have required an emergency supply interruption. It can be installed in 90 minutes and without the lead- time necessary to arrange notifications. It requires nothing more than a minor trench opening to install it.

	The Infrastop installation equipment is mounted on the exterior of the live water main
	The water main is cut open in a sealed chamber and the section of cut pipe is removed. The knife valve is shut and the cutter station is removed.
	The plug insertion station is attached. When the water main needs to be shut off the knife valve is opened and the plug is screwed down into the water main. From start to finish the entire installation process takes less than 90 mins and does not interrupt the water supply.

In conjunction with Infrastops, temporary water supply lines are connected to all properties.
When the Infrastop is engaged all residents are switched across to the temporary supply.

Figure 3: Infrastop installation process

By using the Infrastop the number of residents affected is shown in the figure below. As can be seen, the number of residents in the shaded area is now comparatively small. Furthermore, none of the residents have any loss of water supply.

Figure 4: Residents affected when installing Infrastops

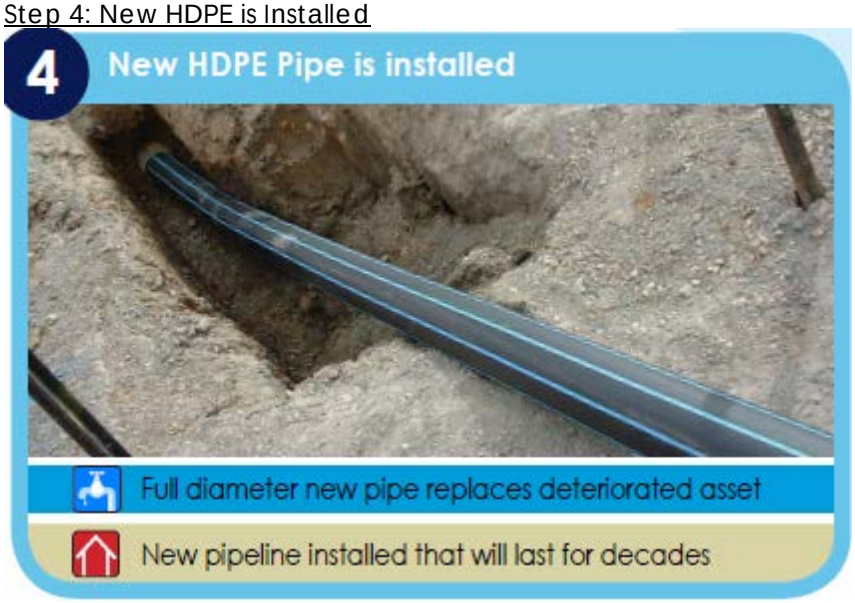
Since the release of Infrastop® to the market, approximately 10,000 units have been installed. Before Infrastop®, in an average year there were between 500 and 600 planned 4 hour shutdowns required to perform the renewal work. Now there are less than 5 required per year.

We are now able to confidently enable water authorities to

- Complete the vast majority of all renewal works without any supply interruption
- Significantly reduce their "water off" hours. An important KPI for all authorities
- Eliminate many of the costly and severely disruptive interruptions involving businesses and key customers where work would have otherwise needed to occur on weekends or after hours
- Significantly reduce the number of customer complaints relating to interruption of water supply. This includes avoiding resident notification, damage to hot water services and several other issues that put a load on the "Faults and Emergencies Communications Centre"

Figure 5 Installing Infrastop® in a 225mm main and a 150mm main

Step 4: New HDPE is Installed



With the main isolated a new HDPE pipe is installed in the same location as the existing main. For reticulation mains it is most common to use pipe bursting. This has the benefit of being able to install a new pipe to the desired diameter whether it be a size for size replacement or an upsize. The client also receives a brand new pipe with exactly the same specification as the pipe that would be installed if dig and replace was used.

The extent of disruption in using this trenchless technique is far less. The figures below contrast a typical pipebursting site with a dig and replace site.

Figure 6: Open cut (left); Pipebursting (right)

Clearly the extent of disruption is far less with the trenchless technique. The only positions of local excavation are at the house connections and the launch and receiving pits.

By volume the majority of the watermains replaced are in the reticulation sizes. But there have also been several projects in the larger carrier sizes as well. In the larger sizes techniques such as slip lining, fold and form and die reduction have been used successfully. Again, the client receives a HDPE pipe, but with a reduced diameter although the diameter reduction is often quite acceptable in the larger sizes.

Step 5: The house connection is made.

When the water main is renewed the service connections are also replaced and the main to water meter line is assessed for renewal simultaneously. In cases where the service connection is deteriorated (quite common for galvanized serviced connections for example) it will be replaced for minimal extra cost. This comprehensive approach effectively eliminates the need for future operational access to the service point.

Step 6: Site Restoration

The final step in the renewal process is the restoration of the site. Clearly with the small excavations at each lateral to restore, the extent is far less than a complete open cut. Footpaths, driveways, tree etc will generally not have needed to be removed or replaced. The resident will not know a renewal has even taken place.

4. Future Direction for Trenchless Water Main Renewal in Australia

Given there is active water main replacement program in progress in Australia, the obvious first challenge for our industry to facilitate a shift from open cut to trenchless. As demonstrated in this paper there is already a compelling case for the use of trenchless methods. As the industry gets more experience and clients become more aware of what is possible it is inevitable that the value proposition will become greater.

The areas that are likely to present themselves as opportunities for our industry are

a. Condition assessment – providing clients with an objective assessment of the condition of the water assets such that a more targeted approach to the timing of renewals can occur - in a similar way to the approach to sewer assets.
b. Development of techniques that are even more “trenchless”
c. Expansion of the renewals in larger diameter water mains.

As time progresses we should continue to measure the total number of water mains renewed each year and the percentage that are done by trenchless methods. As an industry, we will have succeeded when the percentage of water mains renewed by trenchless methods is as great in water as it is in sewer.