INVESTIGATION OF SEWER BLOCKAGES DUE TO TREE ROOTS

Paper Presented by:

Graham Thomson

Author:

Graham Thomson, *Sewerage Reticulation Technical Officer*

Barwon Water

71st Annual Water Industry Engineers and Operators' Conference
Bendigo Exhibition Centre
2 to 4 September, 2008

INVESTIGATION OF SEWER BLOCKAGES DUE TO TREE ROOTS

Graham Thomson, *Sewerage Reticulation Technical Officer*, Barwon Water

ABSTRACT

Reticulated sewer systems form an integral component of the water industry as they transport sewage from property connection points to the larger trunk sewers.

With the increase in accountabilities due to independent regulatory authorities and the potential impact on factors such as customer service and the environment, the reliability of this service has never been more critical.

The aim of my Kwatye project was to examine what strategies the water industry is utilising to improve the reliability of reticulated sewer systems. In particular, to investigate what systems are being used to address blockages due to tree roots and to determine if chemical treatment could be undertaken at Barwon Water within areas where it is currently not utilised.

Site visits to various water businesses were undertaken to meet with operational personnel, discuss what they were doing and determine what particular operational issues they had encountered while tackling tree root blockages.

1.0 INTRODUCTION

The last few years has seen an increase in the quantity of blockages in reticulated sewers and the majority of these have been due to tree root intrusions.

Based on information from the National Water Commission 2006/07 National Performance Report, Figure 1 indicates that since 2000/01 twelve water businesses across Australia have had averages ranging from 54% to 93% of their sewer blockages due to tree roots.

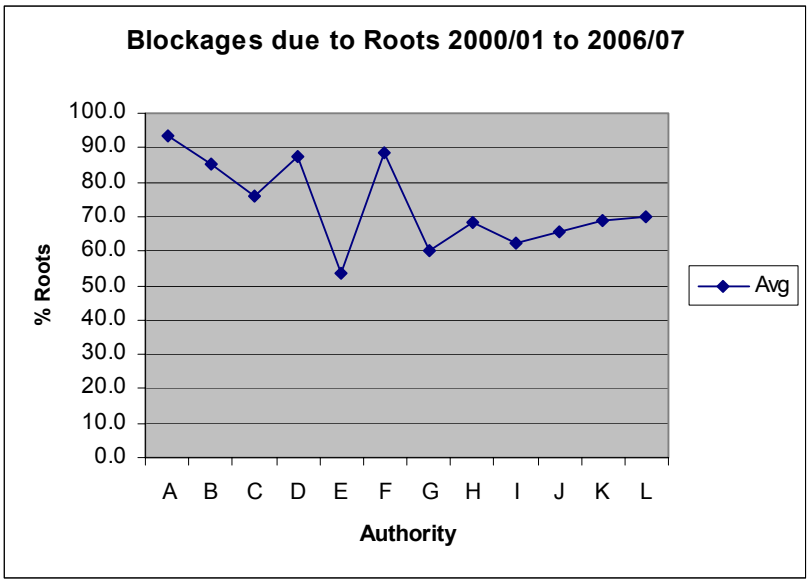

Figure 1: ***Blockages due to tree roots comparison within Australia***

2.0 COMMON SEWER BLOCKAGE CLEARING METHODS

A summary of the common sewer blockage cleaning methods used in the water industry is provided in Table 1.

Table 1: ***Summary Blockage Clearing Methods***

Method	Description
Rodding	This process uses either a mechanical or manually operated ratchet drive connected to hardened steel rods fitted with a specific head. This type of work is typically undertaken on a reactive basis and is at least a two-stage process, i.e. Stage 1 is with a point type head to "break" the block then Stage 2 is with a cutter type head to clear the pipe.
Jetting	This uses high-pressure water (103 bar to 690 bar) to drive specific heads fitted to the end of a hose. The water used is usually from the reticulation water system, i.e. fireplug. Recent developments have seen the use of recycled water and/or equipment being modified to suit to use "water" from the sewer main itself. The heads fitted are typically for a specific purpose, eg removal of rubble, root cutting etc. This process usually removes material from pipe, eg rubble. Some authorities refer to this method as "flooding".
Root Cutting	Similar to jetting using high-pressure water but specific heads are used that enables the equipment to cut the tree roots. Basically two types of heads are used. One where nozzles in the head does the cutting and the other where a hydraulic motor "drives" a cutting head similar to a "hole saw" fitted to an electric drill.
Chemical	In this process a root inhibitor chemical is applied to the reticulation sewer pipes considered to have tree roots present. The chemical historically has been applied via a "foaming" process but other processes have been trialled, eg spot spraying in conjunction with close circuit television (CCTV) equipment. There are two philosophies regarding this method and they involve when and/or if pipes should be root cut.
Dig/Repair	This method is generally restricted to isolated cases and site-specific conditions that require a unique approach to clear a blockage and/or defect. Repairs normally undertaken as part of planned program there are situations where a reactive excavation and repair is required eg collapsed pipe, equipment trapped within the sewer pipe.

3.0 INVESTIGATION

3.1 Contacts

Shortly after receiving the Kwatye award advice was received that Water Services Association of Australia (WSAA) was considering a project to address the high rate of blockages due to tree roots. Contact was made with Evelyn (Eve) Rodrigues, who had been appointed as the WSAA project coordinator. Eve advised it was the intention of WSAA and the Commonwealth Scientific and Industrial Research Organisation (C.S.I.R.O) to undertake a three-year collaborative research project for "Optimising the

Management of Sewer Systems with Root Intrusions". As a result of these discussions it was agreed we would maintain contact and assist each other where required.
With the assistance of contacts that had been established within the water industry, communication was established with various other water businesses to assist with this project. The Victorian Essential Services Commission, the regulatory authority responsible for monitoring the water industry in Victoria, was also contacted to provide data relating to blockages.

In addition to the above a survey was developed and distributed a survey; to various water businesses within Australia in order to determine what maintenance practices they were utilising and the gravity sewer profile in their area of responsibility.

3.2 Site Visits

The first site visit was in October 2007 to Newcastle with Hunter Water. The Hunter Water people were very gracious with their time and a very informative meeting was held. The main outcome was the exchange of ideas and experiences associated with what strategies that were being used to control sewer blockages.

My next foray was to attend a WSAA Asset Management Workshop in Melbourne in November 2007 at which, in addition to providing a presentation, I was able to meet the prospective representatives of the steering group associated with the WSAA/CSIRO project. As a result of my Kwatye project and incorporating Barwon Water's commitment towards this WSAA blockage project it has been agreed that there will be input on my part to the steering group.

In March 2008 it was off to visit to Central Highlands Water (CHW) where I again met with some operational personnel. I was briefed about the systematic approach CHW was shortly to undertake in the township of Maryborough. In order to reduce the current high rate of blockages in this town a targeted programme involving a root cutting and chemical treatment is being undertaken on the majority of reticulated sewer pipes in this area. As a result of this meeting it has been agreed CHW and Barwon Water will share the information and experiences gained from this work.

In April 2008 it was back to Newcastle to attend the WIOA New South Wales conference and attend the first workshop meeting for the WSAA/CSIRO collaborative blockage project, which was held in conjunction with this conference. The main purpose of this two-day workshop was essentially to establish the scope of the blockage project, confirm who was going to be involved and what particular responsibilities were being allocated. The other benefit was WSAA members participating in the workshop were able to attend a WIOA conference. Also during this time I was again able to catch up with Hunter Water and experience first hand its field operations regarding the chemical treatment of sewer assets. On my return to Melbourne I called in to Sydney Water where I was able to meet with Eve and Kim Latchford and again undertook very productive discussion, which was considered mutually beneficial.

3.3 Survey

The survey developed for the Kwatye project was circulated to eleven organisations with nine surveys being returned. The information confirmed the processes detailed in Section 2 were in use and there was no particular method being exclusively used. It did emerge however that some water businesses currently do not undertake any form of chemical

treatment within their sewer system. The main reason for this appears to be related to Occupational Health and Safety (OHS) concerns and the effectiveness of this process.

3.4 Field Trials

At Barwon Water there are areas that currently have a high blockage rate due to tree roots. In some of these catchments the preventative maintenance works undertaken do not include any form of chemical treatment. Previous history of chemical treatment in some areas indicates there is potentially a high risk of disruption to the biological treatment process at particular water reclamation plants. As the plants have a regulated discharge licence, the potential for non-compliance with their operating licence is considered too great. Another reason chemical treatment has not been used is some treatment plants have a proportion of the discharge being used as recycled water and thus there is a possibility of negative impacts on this high profile process.

It has been found the current practice of regular root cutting and jetting programs can be both time consuming and potentially less effective than chemical treatment.

In order to evaluate if chemical treatment can be used in an area where currently it is not used a trial has been undertaken using strict guidelines and controls in Anglesea. The reason Anglesea was selected is that as shown in Table 2, there is a higher rate of blockage there. Contributing factors such as the depth of the gravity sewers being generally less when compared to other areas, similar age, eg constructed early 1970s, and material, eg 80% vitreous clay (VC). There is also the factor the area is highly vegetated with native trees and these are seen as part of the attraction to the area.

Table 2: ***Blockage comparisons for Anglesea***

Sewer Blockage Details		Financial Year		
		2005/06	**2006/07**	**2007/08**
Qty Blocks	All Barwon Water	894	1126	905
	Anglesea	99	76	83
	% Blocks in Anglesea	11.02%	6.74%	9.17%
Blocks/100km	All Barwon Water	40.3	50.6	40.3
	Anglesea*	153.5	117.8	128.7

** = Pipe lengths used for all years are as at 1 December 2007*

It has been found that to undertaking works during the peak holiday periods in Anglesea is often difficult due to the limited access and issues associated with holidaymakers unfamiliar with the area. Also the incident of a blockage can generally be associated with an overflow and so there are environmental issues that are of obvious concern and thus reflect poorly on Barwon Water's image.

Graph 2 indicates the monthly flows during 2007/08 at Anglesea Water Reclamation Plant (WRP), which demonstrate there are distinct flow patterns, which are due to the influx of holidaymakers. This flow pattern has often increased blockages in pipes that normally function appropriately at lower flows.

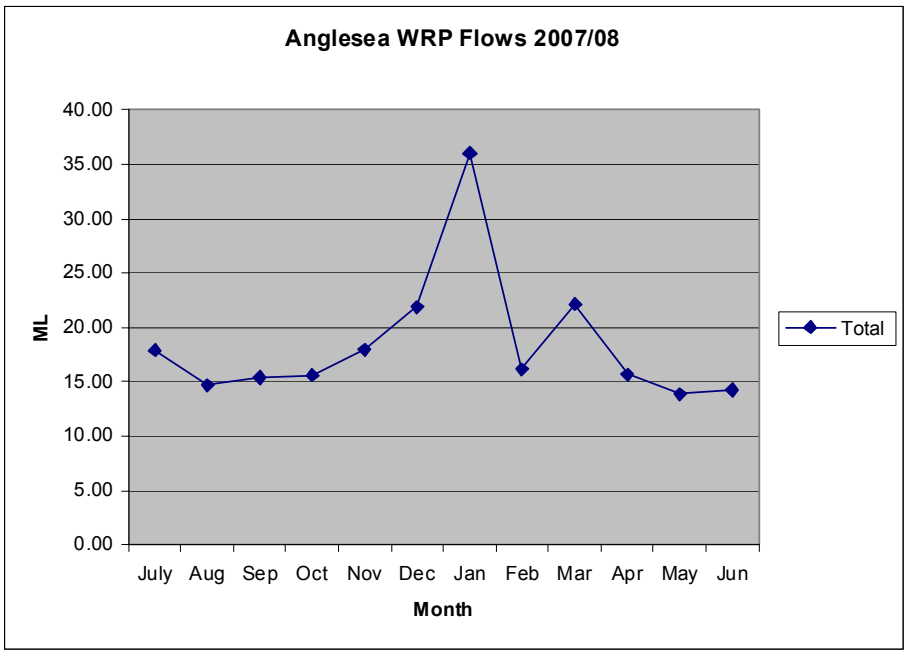

Figure 2: *2007/08 Flows at Anglesea WRP*

The first step in selecting chemical treatment was to source some applicators, obtain a sample of the products they would use and have a laboratory undertake an anaerobic inhibition test. This test provided an indication of likely toxicity of a chemical, at various concentrations, to the biological treatment process. The results of this test helped determine the amount of chemical acceptable for use in the trials.

The next step was to select an area within Anglesea where field trials could be undertaken. The design of the Anglesea gravity sewer system provided the ability to select a particular catchment where strict controls and monitoring could be undertaken.

Following the successful testing of chemicals in the laboratory two field trials were undertaken. The two methods used were spot spraying after cutting and foaming without cutting. The field trials have only recently been completed and the results will be assessed over the next twelve to eighteen months. At regular intervals, the pipes will be checked using CCTV equipment for signs of root growth. Also, for comparison purposes, other pipes where root cutting only has been undertaken are being monitored.

The "new" technique of spot spraying that was carried out has the advantage that it is undertaken in conjunction with CCTV equipment allowing observations to be undertaken on what condition the sewer asset is in at time of application.

3.5 Performance

The industry measures the performance of reticulated sewers usually by comparing the number of blockages experienced per 100 kilometres of sewer main (blocks/100km) or number of blockages per 1000 customers (blocks/1000).

One of the issues identified during this project is that when using the blocks/100km as an indicator all pipes, regardless of function or size within a water business's area of responsibility, are currently included.

Also, from data collected at Barwon Water most, if not all, sewer blockages are associated with gravity pipes of ≤300mm in diameter. Table 3 indicates there is a 20% increase in blockage rates when using just the gravity pipes of ≤300 mm in diameter.

Table 3: ***Comparisons of Blocks/100 km for Barwon Water***

	Financial Year		
	2005/06	**2006/07**	**2007/08**
Quantity of Blockages	894	1126	905
Blocks/100 km (all pipes)	40.3	50.6	40.3
Blocks/100 km (Barwon Water Gravity ≤300mm)	48.1	60.7	48.7

Depending on the proportion of gravity pipes ≤300 mm that other water businesses have within their system will obviously vary this difference, but it will result in an increase to the blockage ratios. It is therefore considered that the water industry could improve its measure of its performance reticulated sewerage systems by including only gravity pipes ≤300 mm.

3.6 Developments

So what is being developed to assist in reducing the number of blockages?

(i) Chemically treating pipes – two main methods
- Using chemical in conjunction with foam either with cutting or without cutting roots.
- Spot spraying chemical after cutting done in conjunction with CCTV equipment.

(ii) Using historical data to plan particular root cutting programs. In some water businesses the analysis includes various weightings for risk and consequence so an overall priority is assigned to a particular pipe.

(iii) Targeting high-risk pipes with planned works on a time basis, eg all pipes near a water body in an area every six months. The prime driver here is that the consequences will have a huge impact, i.e. overflow to the water body.

Other improvements that have been identified during my project are as follows: -

(i) Equipment used has been upgraded to utilise the water directly from the sewer main by recycling through special filters incorporated into the machine. This demonstrates the flexibility newer technology has and the capability for significant water savings while undertaking both planned and reactive works.

(ii) The increase of works being undertaken in the rehabilitation of sewer pipes, including the house connection points. Although rehabilitation is generally associated with an aging and/or defective pipe there is also the associated factor that by undertaking this work there will be an improvement in the performance associated with blockages.

(iii) By evaluating CCTV footage there are cases where an isolated section of a pipe can be repaired and it will improve the overall performance of a pipe. This is generally referred as a dig/repair or spot repairing and depending on various scenarios can result in an increase in a sewer pipe performance in a cost effective manner. There are circumstances where the repair costs are shared with property owners and/or developers as they are of a mutual benefit or the location of defect is in an area of shared responsibility.

4.0 CONCLUSIONS

- In order to more accurately reflect the performance a gravity reticulated sewer it is considered that a KPI measure of blockages in gravity sewers of ≤300 mm per 100 kilometres be considered for implementation within the water industry.
- Currently there does not appear to be an easy and/or quick fix to the issue of tree roots entering a gravity sewer system but the water industry is prepared to tackle the matter by allocation of specific resources to undertake research in what can be done to improve the performance of the reticulated sewer system. The study of chemical treatment in Anglesea is anticipated to assist in this process.
- The Kwayte project has assisted me in updating my knowledge as to what the current position is concerning blockages within the Australian water industry.
- The communication undertaken has assisted in building and consolidating the network of contacts within the water industry.
- The first WSAA collaborative project with CSIRO should enhance the progress the water industry undertakes in managing sewer blockages due to tree roots.

5.0 ACKNOWLEDGEMENTS

Without the support of my family the work undertaken on this project would not have been possible. Also I would like to thank the following that to date have provided me with valuable assistance, encouragement and support in undertaking this project.

- Environmental & Process Technologies (Division of Biolab)
- Water Industry Operators Association (WIOA - George Wall)
- Barwon Water (David Barkley, Lincoln Thomson, Adam Polkinghorne)
- Central Highlands (Neville Pearce, Jon Gooding, Jamie Bryce)
- Essential Services Commission – Victoria (Marcus Crudden).
- Water Services Association Australia (David Cox, Evelyn Rodrigues)
- Hunter Water (Jeremy Silk, Ken Wilson, Debbie Selden).
- Sydney Water (Kim Latchford)

6.0 REFERENCES

National Water Commission, National Performance Report 2006-07, Major Water Utilities;
Essential Services Commission – Water Performance Report, Performance of Urban Water and Sewerage Business 2006-07

7.0 DISCLAIMER

The views and ideas expressed in this report are those of the author and in no way reflect those of WIOA, Biolab, or any of the water businesses or organisations mentioned.