THE TRIALS AND TRIBULATIONS OF REDUCING SEWER BLOCKAGES

Paper Presented by:

Matt Beattie

Authors:

Matt Beattie, *Networks Engineer,*
David Brownbill, *Systems Engineer,*

Campaspe Asset Management Services

70th Annual Water Industry Engineers and Operators' Conference
Bendigo Exhibition Centre
4 to 6 September, 2007

THE TRIALS AND TRIBULATIONS OF REDUCING SEWER BLOCKAGES

Matt Beattie, *Networks Engineer***,** Campaspe Asset Management Services
David Brownbill, *Systems Engineer,* Campaspe Asset Management Services

ABSTRACT

Sewer blockage reduction and the maintenance of that reduction is an important consideration for most water authorities. Targets are set, resources are allocated and the achievement of those targets should then be a mere formality. Shouldn't they?

This paper will discus an asset management company's evolution of this approach, with respect to the delivery of sewer blockage targets to a regional water authority.

The major areas this paper will discuss include data interpretation of initial blockage rates, determination and allocation of resources to achieve set targets and a discussion on the positive and negative aspects of each of these with present performance, future targets and recommendations. Through these discussion points it will be shown how client's targets can be met by using internal resources and investment with sound data collection and monitoring techniques.

1.0 INTRODUCTION

Campaspe Asset Management Services (CAMS) is an as asset management company formed by two parent bodies United Utilities and APA Group. CAMS maintain assets for Coliban Water, a regional water authority in central Victoria. These assets include Water Treatment Plants, Wastewater Reclamation Plants and both water and sewer reticulation systems.

The combined sewer reticulation is 1,697km long, spread across 23 central Victorian towns from Kyneton in the south to Echuca in the north. The biggest system in the region is Bendigo which will be the focus for this paper.

Bendigo has 978km of sewer mains of varying materials and pipe sizes. It has one of the highest sewer blockage rates in Australia averaging 107 blockages per month between the years 2002 -2005 years, with over 4573 identified blockage sites. This high blockage rate has many implications for a Water Authority and in this case the maintenance contractor that services them. This paper will discuss how CAMS approached the high blockage rate in Bendigo. These include;

- Data review and data compilation
- Review of the blockage rate and possible ways to reduce it
- Initial targets and actions
- Methodology and future applications to address problem sewers
- Using in-house and external resources
- Existing targets/performance and future recommendations

2.0 DISCUSSION

2.1 Data Review and Data Compilation

Phase one of the blockage reduction program was to combine and examine the data in an initial review. The outcome of this indicated that the data was not in a usable format for analysis or interpretation. After completing some data cleansing various multiple blockage sites were identified and these formed the basis for our initial maintenance activities.

Phase two was the development of the database. Over a third of the recorded blockages in Bendigo were not allocated to particular sections of the sewer main. A process of identifying the manhole length in which these blockages had occurred involved aligning addresses and customer information to manholes. After this data had been changed into a usable format CAMS was able to review historical blockage data, update data using details from operator activity reports and then use this information for analysis and interpretation. Overall the data compilation and database development took over 12 months to complete using a variety of CAMS Information Technology and Engineering personnel.

2.2 Review of the Blockage Rate and Possible Ways To Reduce It

The database allowed greater flexibility in the interpretation of data and allowing better targeting of resources to control sewer blockages. Blockages in Bendigo were generally tree root blockages most likely to be found in 100 – 150mm Vitrified Clay (VC) sewer mains. The following graphs helped establish the relationship between the number of blockages per km of main with respect to pipe diameter and material.

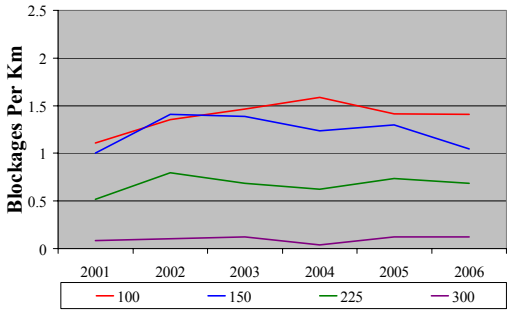

Fig 1: Sewer ***blockages per km for pipe diameters. Note the higher blockage frequency in 100 and 150mm diameter sewer main.***

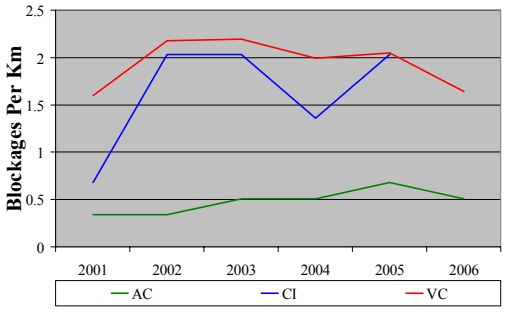

Fig 2: Sewer ***blockages per km for pipe materials. Note the higher blockage frequency in VC and CI sewer mains***.

Having established VC and Cast Iron (CI) sewer mains of 100 and 150mm as being the worst performing sewer mains in Bendigo. The following graphs (Figures 3 and 4) put these graphs into context with regard to the percentage of materials and pipe size within the Bendigo sewer reticulation.

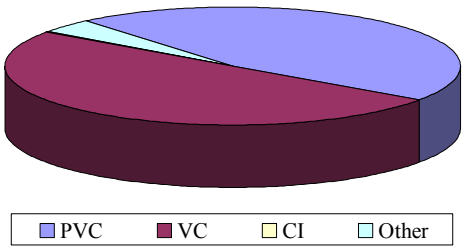

Fig 3: ***Bendigo System by Material (%)***

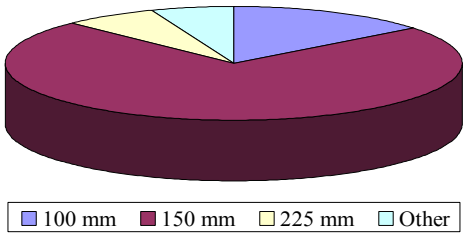

Fig 4: ***Bendigo System by Diameter (%)***

As cast iron makes up less than 1% of the Bendigo sewer reticulation, focus was determined to be on VC pipes having a diameter of 100mm and 150mm.

After identifying the sewer mains most susceptible to blockage the number of single and multiple blockage sites were investigated to establish which sites would give the best results if they were treated (Figure 5).

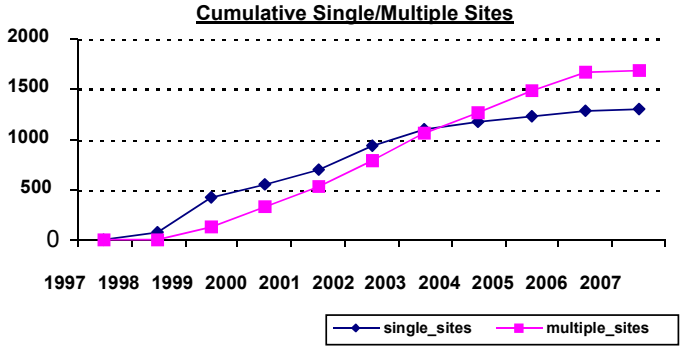

Figure 5: ***Number of cumulative single and multiple blockage sites in the Bendigo Sewer Reticulation. Note the higher number of multiple blockage sites.***

Finally the blockage causes were considered. The following graph shows the different causes of sewer blockages within the Bendigo reticulation system over the last 3 years (Figure 6).

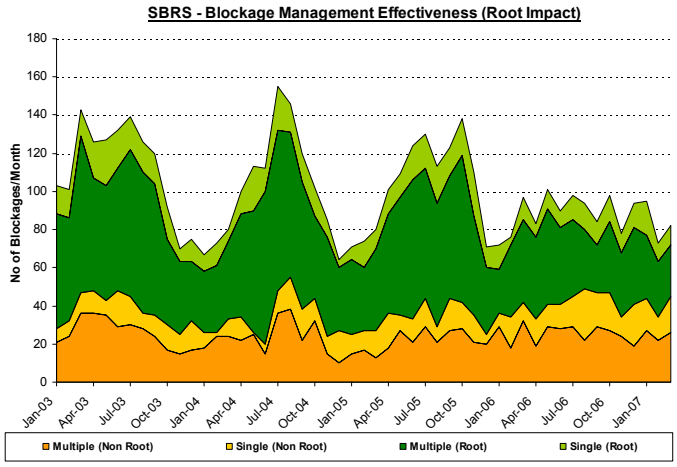

Figure 6: ***Causes of sewer blockages in the Bendigo sewer reticulation in actual numbers per month. Note the higher proportion of tree root blockages.***

So the focus of the sewer blockage reduction strategy was on multiple blockage sites in small diameter sewers, with consideration for the treatment and control of tree root growth.

2.3 Initial Targets and Actions

For the period of the contract 2003 – 2007 financial year periods CAMS was required to maintain a blockage rate of 150 blocks per 100km (12 monthly rolling average) for the Bendigo system. This target was considered to be quite manageable using the existing sewer truck and contracted trucks as determined by reactive works.

After July 2007 the blockage rate target reduced to 80 blocks per 100 km as a 12 monthly rolling average. In November 2005 as part of the phase one data review, 837 most frequent blocking sites were identified and a maintenance program developed. This incorporated a tree root foaming program, sewer root-cutting program, and a CCTV program, utilizing both internal and external resources.

2.4 Methodology and Future Applications To Address Problem Sewers

In order to allow us to track all the different programs and works being completed a point scoring system was developed that ranked each sewer manhole length in the Bendigo reticulation.

The point scoring system incorporated all the major aspects of a sewer manhole condition, including the material type, diameter, blockage history (i.e. number of blocks and blockage result e.g. overflow), whether the pipe length has caused environmental or customer related incidents and if available it's CCTV report scores. The points system was scaled to reflect what we knew about the system and what was the consequence if an overflow occurred e.g. as we knew that VC mains were more likely to block they were allocated a score of 10 as opposed to a PVC main which was allocated a score of 2. This is highlighted by the following Table (Table 1).

Table 1: ***Example of the point allocation systems used to rank each sewer length***

Description	Value	Points
US MH No	LG12A/10	N/A
DS MH No	LG12A/11	N/A
Diameter	150mm	10
Material	VC	10
No of Blockages	6 x Tree Roots = 60 1 x Other = 5	65
CCTV Results WASA codes	Structural grade 5 = 50 Service grade 5 = 50	100
Customer related incident	Nil	
Environmental related incident	Nil	
Total		195

This point scoring system allowed individual sections of sewer lengths to be ranked for scheduling with periods between repeat maintenance being outlined in Table 2.

Table 2: ***Scheduled periods for sewer lengths between maintenance actions.***

Maintenance Action	Next Maintenance Action
Jet	6 Months
Root Cut (Warthog or mechanical cutter)	12 Months
Foaming	36 Months

This set out the basis for the preventative maintenance program. The lists are issued every 3 months to the sewer jet truck operators and are completed as time permits between sewer blockage reactive works. Essentially each Bendigo sewer lengths has a current status report determining when preventative maintenance is required to minimize likely future blockages.

2.5 Using In-house and External Resources

CAMS determined in 2006 that to achieve the required work rate necessary to reduce sewer blockage numbers in line with contract targets, work would either be outsourced or a new sewer jetting truck would have to be purchased. With 8 years remaining on it's the current contract with Coliban Water, CAMS decided to invest in the appropriate plant to facilitate this resource internally. A sewer truck with root foaming capability was purchased effectively bringing all sewer maintenance in house.

This goes against the current industry trend for outsourcing. CAMS have found it advantageous in many ways through:

- More efficient program management as operators have electronic access to plans and spreadsheets (laptops).
- Operator local knowledge allows greater productivity – access and location issue knowledge, traffic implications; condition and flow rates are more easily alleviated.
- Communication is ongoing and constant as part of the normal work day to overcome obstacles and difficulties.
- Reporting of completed and future works fits into CAMS existing reporting framework.
- Allows the flexibility for operators to make decisions in the field without receiving specific direction to complete that work.

These advantages have allowed CAMS to produce better results then those that we had when we outsource for this type of work when considering work failure rates (Fig 7).

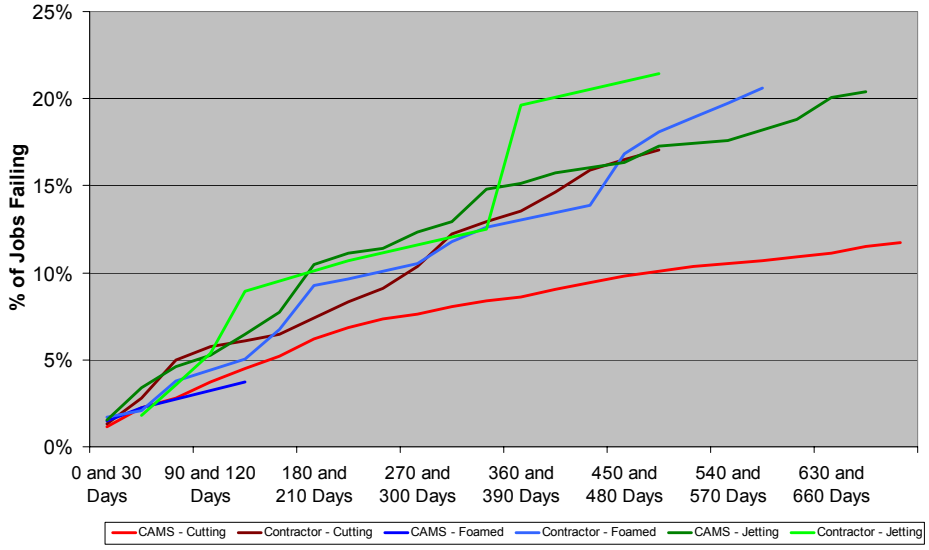

Figure 7: ***Time periods for re-blockage in sewer mains following work performed by CAMS and external resources.***

2.6 Existing Targets/Performance And Future Recommendations

The result of this combination of work has reduced the blockage rate to 111 blocks per 100km (12 monthly rolling average) in Bendigo, its lowest for 7 years. The July 2007 target of 80 blockages (12 monthly rolling average) has not been reached, however over the last 15 months since the inception of the program, we have reduced the average monthly blockage rate from 107 blocks per month to 88 blocks per month.

The results of this are represented in the Fig 8 – Blockages profile for Bendigo.

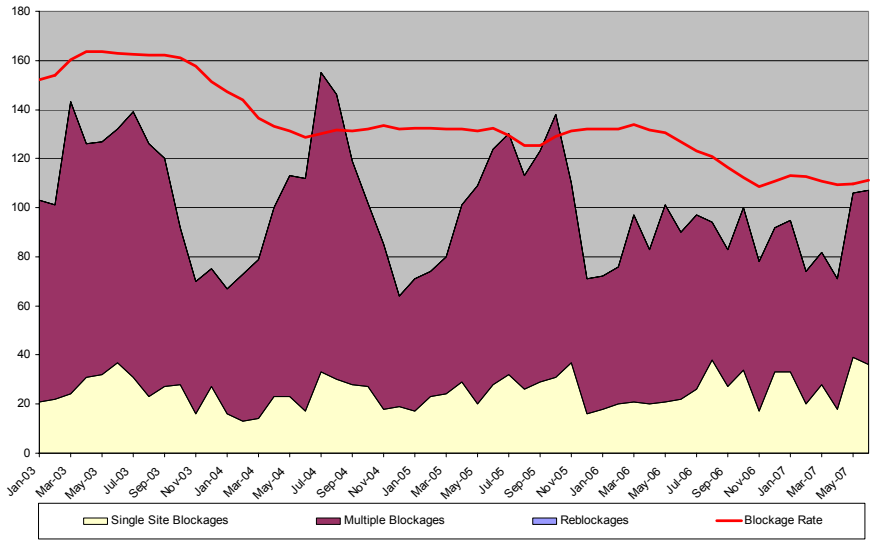

Figure 8: ***The blockage profile for Bendigo showing the decline in blockages per month since the inception of the blockage reduction program..***

CAMS are constantly reviewing the database and our preventative maintenance program to try at meet the required targets. This however will not be undertaken alone and we are working closely with Coliban Water across all aspects of capital investment programs including sewer renewal, sewer in-situ re-lining and sewer hydraulic modelling to ensure that all programs are run simultaneously without overlap of resources. The CAMS database provides valuable input into this integrated approach between the asset maintainer and the asset owner to facilitate an integrated sewer blockage reduction plan.

3.0 CONCLUSION

This paper has shown how CAMS has approached the problem of reducing sewer blockages to set targets, and it covers four major areas:

- Firstly the importance of sound, consistent data to allow for the correct interpretation of what the cause for blockages are and just as importantly were they are occurring within the sewer reticulation system,
- Secondly the allocation of appropriate resources to address and attack the identified blockage sites within the sewer.
- Hand in hand with that application is the third point, which is the ability to constantly monitor the system the effects that the maintenance and other programs are having so that resources can be tailored appropriately.
- And finally the integration of all capital and maintenance actions to facilitate a targeted approach for the sewer reticulation system as a whole.

4.0 ACKNOWLEDGEMENTS:

To **David Brownbill** for his time, limitless patience and database expertise.
To our operators, **Alan Bull, Jeremy Morgan, Geoff Gillin** and **Michael Philp** for actually doing the work.
To **Ann Lansberry** and **Mike Andre** for their guidance on the big picture and ultimate direction.
Finally to **CAMS** and **Coliban Water** for providing the opportunity to tackle this issue in

partnership.