LEAKAGE – MORE THAN SMOKE AND MIRRORS

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ABSTRACT

Obtaining best practice in the Water Industry is always a difficult task, given the water shortages throughout Victoria from the ongoing below average rainfall; it is critical that Water Companies do every thing in their power to minimise non revenue water. Water Companies have developed marketing campaigns to enable their customers to reduce the amount of water usage and wastage by promoting water wise products such as low flow shower heads, garden mulch, tap timers etc. However, generally very little is being done to identify areas with unusually high night flows and the development of programs to locate leaks and reduce these flows. During the early hours of the morning customer usage should be minimal, however, if there are high night flows it may indicate a high level of leakage.

Water Companies must calculate the economic, social and environmental value of their non-revenue water and implement strategies to reduce this amount. There are many and various tools and work practices available to identify and reduce non-revenue water, including area metering, pressure reducing valve controllers, step testing, telemetry, night flow rates, etc.

This paper will concentrate on the use of acoustic logging equipment and correlation in proactive leak detection and the financial benefits of locating "hidden" leaks. There has been a misconception that this type of technology is more like smoke and mirrors. However, it will demonstrate the real benefits of using this equipment, the financial payback against the cost of water and the environmental and social benefits of saving water.

South East Water has implemented a program of using acoustic leak detection and correlation in areas with high night time flows and is systematically moving through the water supply zone locating and repairing leaks. All leaks are quantified and recorded against the asset register to determine the type of failure. This paper will also demonstrate the benefits of using this equipment in a reactive manner, the financial payback of implementing acoustic loggers and correlation.

1.0 INTRODUCTION

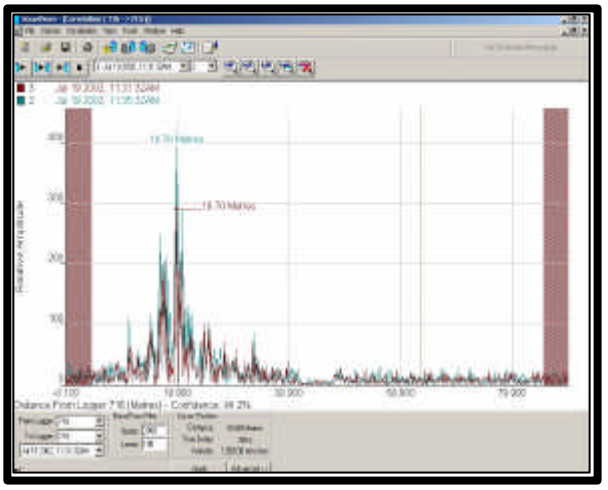
South East Water is committed through its Water Conservation Plan in reducing the amount of water leakage throughout its water supply system. We are undertaking a program of using new acoustic technology that will locate hidden leaks and pinpoint the position of the leaking water main.

Generally, when a water main leaks it is visible to the public. However, many water leaks will never rise to surface as they will enter straight into the drainage system or are trapped under thick road pavement and will drain into the network of conduits under the ground.

The introduction of acoustic loggers that operate like a mini computer are able to listen to the water main at a level that the human ear will not pick up and identify if the water main has failed.

By placing the acoustic loggers on surface fittings such as fire hydrants and valves the loggers record the noise level of the water main over a series of short intervals.

The South East Water officer in the field down loads the recordings from the loggers to a laptop computer and a software program is able to correlate the time delay between the loggers of the sound of the water leaving the pipe.



A distance between the acoustic loggers is calculated and the program produces a chart of the location of the water leak. The loggers are sensitive enough to identify leaks on the 20 mm property service pipes as well as the water main in the street.

A small water leak of 1 litre per minute will waste over ½ million litres over 12 months and this technology will help to identify these leaks and will ensure our water resources are not being wasted.

2.0 CASE STUDY

The Preston Water Supply Zone was identified as higher than normal night time flows through our bulk meter that indicated that there is leakage in the area.

An operator with a set of acoustic loggers has been working through the zone on a daily routine covering approximately 5 kilometres of water mains per day. The area covers the suburbs of Port Melbourne, St Kilda South Melbourne and Albert Park. There is a mixture of high residential area, business and industry areas. Fittings are generally located in the footway area, however, where valves and fireplugs are located within the roadway, the loggers are small enough to be protected from the traffic.

The area covered each month is recorded on our GIS system and all leaks identified and repaired are recorded on a database. All leaks that are found are quantified in a flow rate of X litres per minute that is used to annualise over a 12-month period for saving in kilolitres. The operators have been trained and instructed on how to calculate the leak flow rate. The Operator is unable to determine when the leak started, some may have been running for years while others may have been leaking for a few weeks.

All leaks are recorded on a database recoding, the type of failure, flow rate and the location of the leak.
The operator uses 1:2500 water reticulation plans to highlight the completed water mains and to locate the location of the water main surface fittings. Also a laptop is used in the field with our GIS data called Field View for addition details of mains location and distances between surface fittings.

Figure 1: ***Field View showing details of Water Mains***

Figure 2: ***GIS Map base on Geo Media is used to calculate the area completed each month***

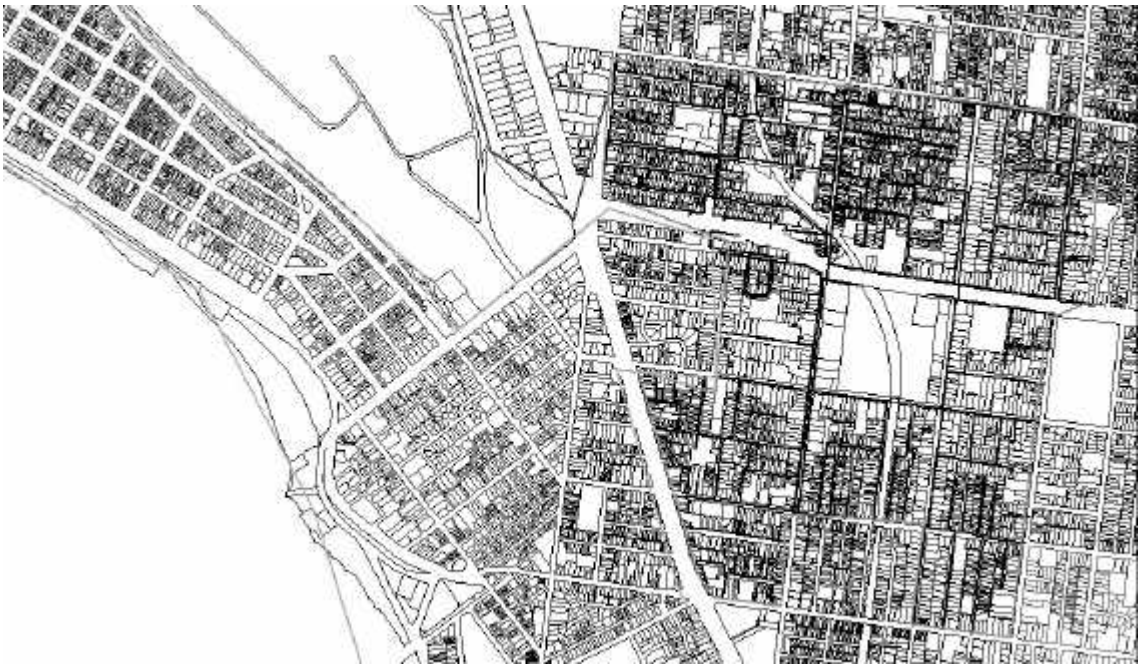


Table 1: *Data set from Geo Media records the water main details to a database of the length, size and type of mains*

UNIQUE ID	ACTUAL SIZE	MATERIAL	CONST DATE	ROAD TYPE	PIPE LENGTH	DIST ZONE ID
151742	150	CAST IRON CEMENT LINED	19691107	ROAD	24.00	1050035081
151863	100	CAST IRON CEMENT LINED	19600602	STREET	51.00	1050035081
151865	225	MILD STEEL CEMENT LINED	19650818	STREET	90.00	1050035081
151867	225	MILD STEEL CEMENT LINED	19650818	STREET	115.00	1050035081
151976	100	CAST IRON (GREY CAST IRON)	18650930	CRESCENT	164.00	1050035081
1050111956	100	CAST IRON (GREY CAST IRON)	18730617	PLACE	11.33	1050035081
1050111957	100	CAST IRON (GREY CAST IRON)	18691008	STREET	4.89	1050035081
151898	100	CAST IRON (GREY CAST IRON)	18670817	PLACE	186.69	1050035081
152167	100	DUCTILE IRON CEMENT LINED	19831025	PLACE	113.03	1050035081
151861	100	CAST IRON CEMENT LINED	19600602	PLACE	129.53	1050035081

2.1 Asset Profile of Preston Zone

Figure 3: *Year Profile of Water Mains Surveyed*

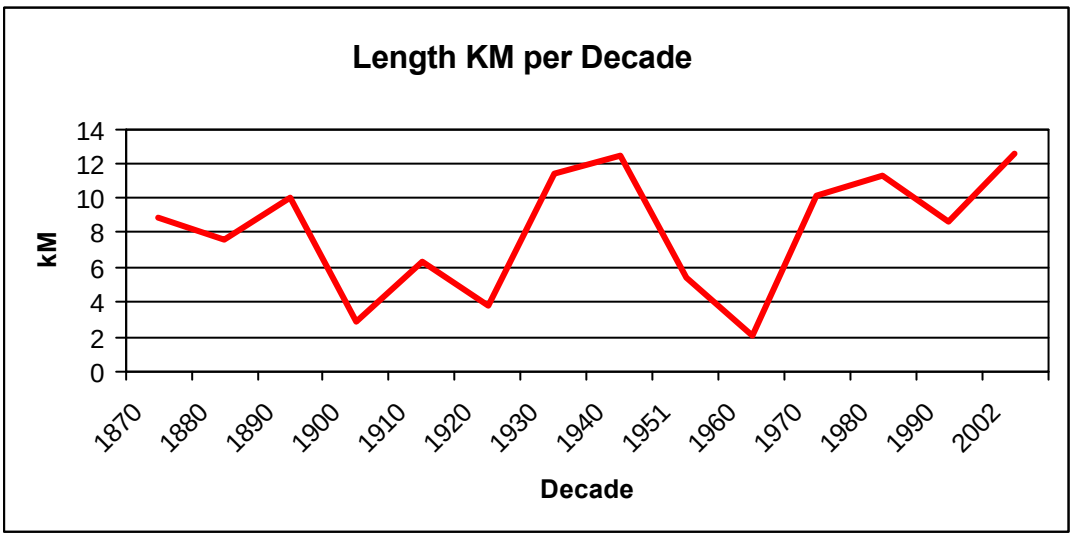


Figure 4: *Material Profile of Water Mains Surveyed*

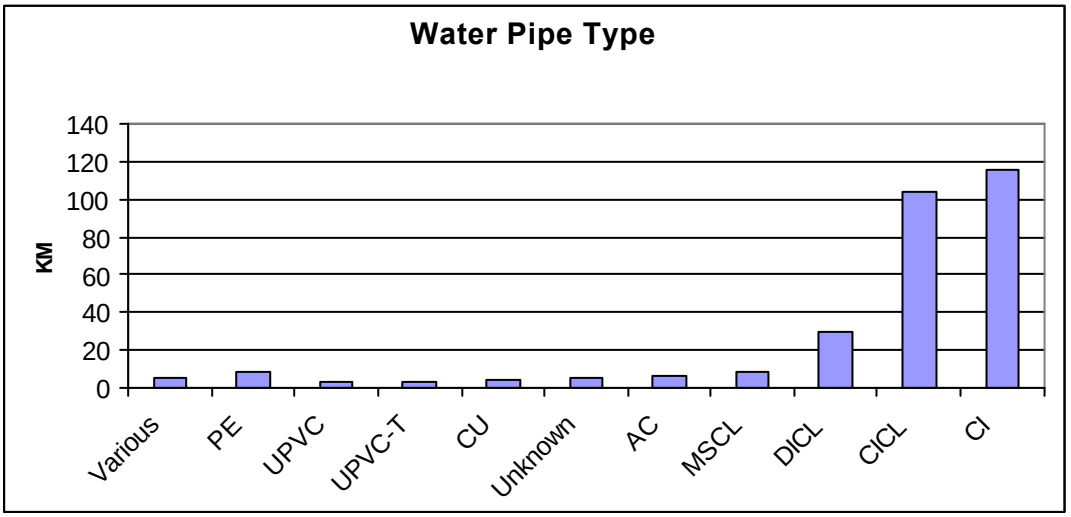
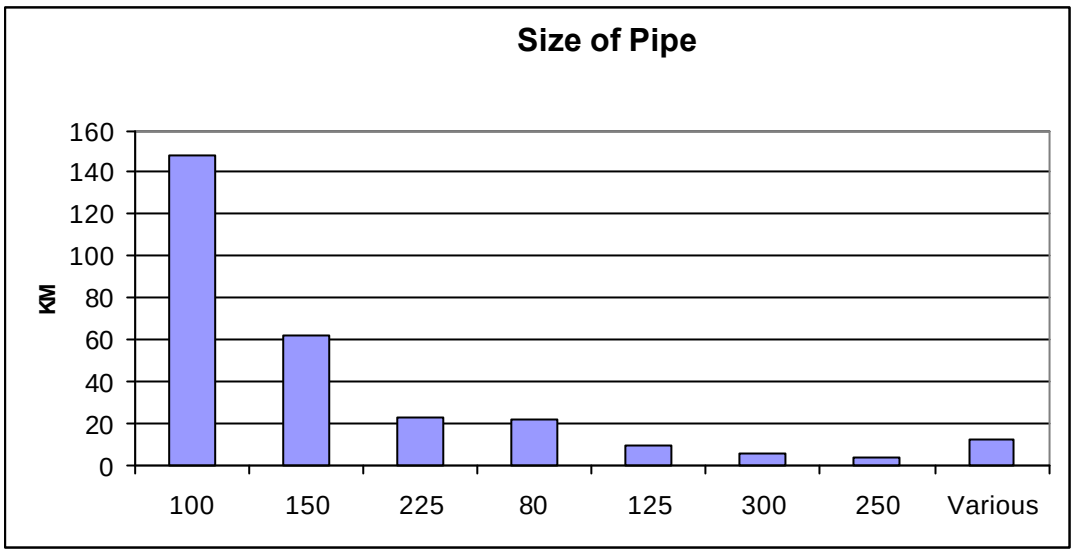


Figure 5: *Size Profile of Water Mains Surveyed*



2.2 Analysis of Data

Table 2: *Length of Water Main*

Month	Length (Km)
November-02	44.294
December-02	33.755
January-03	14.343
February-03	42.549
March-03	62.819
April-03	36.741
May - 03	52.890
Total	**287.392**

Table 3: *Location of Leak*

Failure Caused	Total	%
Fire Service	5	4%
Fitting	52	44%
Main	9	8%
Meter	20	17%
Service Pipe	23	19%
Tapping	9	8%
Total	**118**	

Table 4: *Leak rate per litre*

Action	Number	Total (kL)	Wholesale Amount	Litres per Minute
Leak Detection Programmed	118	248.465	$77,000	4

Table 5: *Total Length of Piping*

Property Service Connections	Length (km)	Reticulation Length (km)	Total Length (km)
22,168	166.2	287.4	453.6

2.3 Data Summary

Since the commencement on 1 November 2002 of the leak detection in the Preston Zone, the going operational expense of the operator was been $37,000. This includes the wages of the operator. The repair costs of fixing the identified leaks by South East Water's approved Contractor are $22,000. The total cost of identifying and repairing the leaks is $60,000.
The annualised leak of the 118 leaks is 248,465 kL and using the wholesale rate of $0.32 per

kilolitre, this represents water saving of $79,500. The water savings of $79,500 subtracted from the expenditure of $60,000 represents a saving of $20,000. Furthermore, the water saved has a great benefit to the environment and contributes to the water reduction during water restrictions.

2.4 Example of a Typical Leak

A typical leak in South Melbourne where there is no obvious signs of any surface leaks, however, the leak detection equipment identifies a leak under the blue stone driveway.

Addition exploratory drilling and listening using ground microphones identifies a high water level under the driveway.

Excavation of the driveway locates an abandoned tapping that is leaking badly on the ferrule bonnet. The water was escaping along the trench and disappearing in the subsoil.

There were no records of this tapping existing.

2.5 Local Customer Information

Prior to commencing schedule leak detection in an area, the local newspaper is contacted to provide information to the local residents about the benefits of leak detection and to increase the profile of the project. The Operators vehicle is clearing marked with Leak Detection badges and the Operation is clearly identified as a South East Water employee. Additional handout information is available for any customers requiring further information.

The loggers have been placed on surface fitting over 1,500 times without any negative feedback. All contact with our customers in field has been positive, as they are impressed with the technology and the proactive manner of seeking out “hidden” water leaks in an effort to reduce wastage.

3.0 CONCLUSION

The Victorian Government has a water conservation target of reducing consumption by 15% by 2010 and South East Water comprehensive Water Conservation Plan has adopted a Non Revenue Water strategy to achieve the target.
Non-Revenue Water - reducing the difference between the volume of water purchased from Melbourne Water and the volume of water recorded on all South East Water customer meters.

To achieve sustainable water management the Government has encouraged water retailers to

embrace certain strategies such as Community Education, AAA water appliances, National Standards, etc. However, in addition to these strategies, which will reduce the amount of water the customer's use, leak detection will reduce the amount of water being wasted by the water company.

This case study proves that leak detection is more than smoke and mirrors as it provides REAL benefits to the Water Company, Customers and the Environment and certainly contributes to the sustainability of the water industry.