PROACTIVE SEWER MAINTENANCE PROGRAM

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73rd Annual Water Industry Engineers and Operators' Conference
Bendigo Exhibition Centre
31 August to 2 September, 2010

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ABSTRACT

East Gippsland Water (EGW) is committed to improving customer service by improving the sewer network performance and has embarked on a program of proactive maintenance of our ageing sewer network in an effort to reduce customer interruptions and improve Essential Services Commission (ESC) and other regulatory compliance. To achieve this we aim to optimise the use of our human, financial and corporate resources. To this end, specialist teams have been developed in a number of areas to ensure a targeted, professional response to customer service and asset maintenance issues. EGW has invested in new equipment to assist staff in addressing these problems.

As part of this proactive maintenance program, EGW has analysed the performance of various sections of the sewer network and have been targeting the poorly performing sections to improve overall performance.

Sewer cutting and root foaming activities as well as routine manhole inspections and other programs have been initiated. The success or otherwise of varying methods is being monitored over time for cost benefit purposes – this proactive maintenance has resulted in a reduction of sewer blockages and general compliance with ESC Key Performance Indicators (KPI).

KEYWORDS

Proactive sewer maintenance, regulatory compliance, performance assessment.

1.0 INTRODUCTION

East Gippsland Water serves an area of 21,000 square kilometres in the far south east of Victoria. The service area extends east from Lindenow, through to the region's capital Bairnsdale, the holiday centres of Paynesville and Lakes Entrance, and on to the wilderness coast and Mallacoota near the New South Wales border. The Corporation also serves as far north as Dinner Plain in the High Country of the Victorian Alps. Water services are provided to more than 23,000 customers and wastewater services to over 19,500, spread across some 30 separate communities. East Gippsland Water employs over 80 people, more than 50% of which are employed in the Technical Services and Operations side of the business.

2.0 DISCUSSION

Why do you need a proactive sewer maintenance program?
East Gippsland Water's sewer network system, as with most aging sewer networks, has a significant amount of aging vitreous clay pipes, many of which are cracked and allowing significant tree root invasion as well as stormwater infiltration. In recent years there has been more emphasis on network efficiency and reliability in the form of the ESC KPIs.

These KPIs are in line with customer service guarantees and standards of service. There has also been an improvement in customer knowledge of the systems and services and an increase in expectations of service delivery. Prior to the introduction of ESC KPIs, response to sewer issues was mainly reactive and resolution of issues was a result of, for example, a blocked and overflowing sewer causing damage and creating costs or becoming an operational nuisance to continually attend to – therefore it was fixed.

The increased accountability of water corporations for effective and reliable service delivery has resulted in a swing from reactive maintenance to proactive maintenance within East Gippsland Water. Table 1 below shows poor compliance with ESC KPIs in regards to sewer network reliability prior to the implementation of our proactive maintenance program.

Table 1: ***Pre proactive maintenance program performance figures***

Essential Services Commission Operational Service standards 2008/2009.					
Sewerage	**Units**	**EGW YTD Result**	**EGW YTD Target**	**EGW Full Year Target**	**Industry Average Target**
Sewerage blockages	per 100km	23.26	15.75	18.90	30.38
Average time to attend sewer spills and blockages	minutes	26.81	30.20	30.20	40.78
Average time to rectify a sewer blockage	minutes	76.25	76.90	76.90	137.30
Spills contained within 5 hours	per cent	98.18	100.00	100.00	91.77
Customers receiving 3+ sewer blockages in the year	number	To be reported Annually		0.00	13.46

3.0 PREVIOUS PROGRAMS AND ISSUES – THE GOOD OLD DAYS

Previous programs revolved around individual depots undertaking ad hoc preventative maintenance programs based on a perception of what needed to be done and when it needed to be done. There was no consistent approach or process involved; there was no overview or analysis of the success or failure of any of the works being undertaken. With over 600 km of sewer pipes – where will we cut today??

The collection of data was inconsistent and sometimes inaccurate – what was the real extent of the problem? There was different interpretations on what were the areas of EGW's responsibility for repair / maintenance and where did it become the customer's responsibility. The existing reporting procedures were ambiguous and required the operator to interpret grey areas when reporting sewer blockages.

4.0 CURRENT PROGRAMS AND ISSUES – A BRAVE NEW WORLD

4.1 Reporting And Analysis

In order to determine exactly what the extent of the problems were it was essential that the data collected was consistent and accurate. With this in mind, work instructions were created and reporting procedures and databases were modified to remove any grey areas and ensure consistent and accurate data gathering. Basic schematics of a sewer system were developed and colour coding of various sections was used to highlight areas of responsibility and screen dumps showed operators exactly where and how the data was to be entered.

To ensure consistency, it became the responsibility of one person to check all of the data entered prior to reporting results to the various stakeholders and, as errors were picked up, undertake training and education of operators to ensure that errors were not repeated.

4.2 Sewer Blockages

A more uniform, coordinated approach to proactive maintenance was then adopted, based on analysis of more accurate data. The 600+ km of mains were then divided into manageable subsystems of between 20 – 25 km of pipe work. The number of main and house branch blockages were then logged to determine the worst performing sections of the sewer network. Figure 1 below is an example of the data gathering and analysis that is performed on the Bairnsdale sewer network.

Cutting Area			A	B	C	D	E	
Sub-System			ALFRED PLACE EASTWOOD GOOSE GULLY B GOOSE GULLY C NICOLE COURT WYYUNG FLUSHING	BRIDGE CALLISTEMON COURT CROOKE NO. 1 CROOKE NO. 2 GOOSE GULLY A PATTIES ROBB STREET TIMBARRA DRIVE	JOHN COURT NO. 1	CALVERT STREET GRAVITY FED GREENE STREET JENNINGS STREET KYLE STREET NO. 1/B RACECOURSE	BENT STREET DAY STREET NO. 1/C NO. 2 PAYNESVILLE ROAD POWER STREET	
Data Summary 2008								
Kilometres of sewer			25.073	21.017	29.074	26.481	25.428	
2008 Analysis	ESC Target	EGW Trigger	2008 Analysis					TOTALS
Main Blocks [SF02]			3	4	31	7	9	54
Connection Blocks EGW responsibility [SF 24]			0	8	4	1	9	
Main Blocks per 100 km of sewer	18.9	15.00	11.96	19.03	106.62	26.43	35.39	
Required Actions				Program to cut	Program Cut 2009	Program to cut	Program Cut 2009	
Data Summary 2009								
Kilometres of sewer			25.073	21.017	29.074	26.481	25.428	
2009 Analysis	ESC Target	EGW Trigger	2009 Analysis					
Main Blocks [SF02]			2	7	15	10	8	42
Connection Blocks EGW responsibility [SF 24]			0	6	10	6	7	
Main Blocks per 100 km of sewer	18.9	15.00	7.98	33.31	51.59	37.76	31.46	
Required Actions				Program manhole inspection program 2010	Cut in 09	Program Cut 2010	Cut in 09	
Data Summary 2010 - sewer pipe lengths updated to include only raw sewerage - reticulation & siphon lines (no pressure sewers or rising mains)								
Kilometres of sewer			27.070	22.719	29.136	26.972	25.574	
2010 Analysis	ESC Target	EGW Trigger	2010 Analysis (01/01/2010 TO 30/06/2010)					
Main Blocks [SF02]			3	4	1	1	4	13
Connection Blocks EGW responsibility [SF 24]			0	2	1	0	2	
Main Blocks per 100 km of sewer	18.9	15.00	11.08	17.61	3.43	3.71	15.64	
Required Actions								

Figure 1: ***Example of sewer cutting spreadsheet***

As can be seen, from the data gathered in 2008, both the ESC and internal EGW KPIs for number of main blockages per 100 km of sewer were being exceeded. The worst performing areas were targeted for proactive maintenance and appropriate resources were directed to those areas and not to the better performing areas (more science, less gut feel!). Block cutting programs were initiated and, in total, proactive cutting of sewer mains increased from 20 km in 2008 to 75 km in 2009. The better targeting of required works enabled this program to be undertaken using existing resources. As a result of this targeted maintenance program, main blockages were reduced in the targeted areas from a total of 54 (2008) to 42 (2009) and to 13 (June 2010). This trend is repeated with the other targeted programs in the Lakes Entrance and Orbost sewer networks.

4.3 Repeat Blockages

Repeat blockages (an ESC KPI) within a 12 month period are identified and proactive maintenance measures are put in place while the cause of the issue is identified and rectified – this may mean a small pipeline repair, tree removal, relining program or other major works such as the installation of a pump station to replace a failing siphon line.

This approach resulted in an improvement in most ESC KPI results. As can be seen in Table 2, not only have main blockages decreased in number but the time taken to respond and rectify reported blockages and / or spills decreased significantly. The number of customers receiving repeat blockages was also reduced as a result of this proactive approach.

Table 2: ***ESC KPI results 2008/09 vs 2009/10***

East Gippsland Water			
ESC Performance Report - Performance Indicators			
Sewerage network reliability and efficiency		2008/2009	2009/2010
Sewer blockages (No.)	Main	99	92
	HCB	58	35
Sewer supply customer-interruptions (No.)		177	106
Sewer supply customer-interruptions restored within 5 hrs (No)		177	104
Total mintues to respond to reported blockage/spill		4168	2455
Total time taken to repair blockage/spill (minutes)		12218	7868
Sewer spills from reticulation and branch sewers (No.)	Priority 1	0	3
	Priority 2	62	47
Sewer spills from reticulation and branch sewers contained within 5 hrs (No.)	Priority 1	0	3
	Priority 2	61	47
Sewer spills not caused by blockages (No.)		5	9
Sewer spills to customer properties (No. spills)		26	21
Sewer spills to customer properties restored within 5 hrs (No. spills)		26	21
Sewer spills within a house (No. spills)		0	2
Sewer Spills Within a House Responded to Within an Hour (No. spills)		0	2
Customers receiving 1 sewer blockage in the year (No.)		162	103
Customers receiving 2 sewer blockages in the year (No.)		13	3
Customers receiving 3 sewer blockages in the year (No.)		2	0
Customers receiving 4+ sewer blockages in the year (No.)		0	0

4.4 Infiltration

An infiltration spreadsheet was developed to identify any relationship between rainfall and an increase in either pump hours or flow. A baseline figure was established based on the assumption of minimal infiltration and normal usage during low rainfall events and subsequent data was analysed against this target – refer to Figure 2. In this example, a baseline figure was set in January 2009 – all other monthly pump hours and flow totals are compared to these figures. If the variation in figures is > 15%, it is highlighted for information; if the variation is > 50%, a further analysis of the data or investigation into possible causes is undertaken. Areas which appeared to have unexplained increased pump activity or flow following high rainfall events were then targeted for smoke or dye testing.

		Bairnsdale No 1 (1)				Bairnsdale No 2 (2)		Bent Street (3)		Bridge (4)		Crooke No 1 (6)		Day Street (8)	
Month	Rainfall (BoM Station 085279 Bairnsdale Airport)	Pump Hours	Monthly Flow (kL)	Variance (hrs)	Variance (flow)	Pump Hours	Variance	Pump Hours	Variance	Pump Hours	Variance	Pump Hours	Variance	Pump Hours	Variance
Dec-08	60.8	168	39703	117%	116%	87.9	114%	44.4	98%	127	95%	48.2	90%	43.1	168%
Jan-09	*9*	*143*	*34202*	*100%*	*100%*	*76.9*	*100%*	*45.4*	*100%*	*134.1*	*100%*	*53.6*	*100%*	*25.7*	*100%*
Feb-09	44.2	140.9	33455	99%	98%	79.7	104%	47.4	104%	125.5	94%	51.3	96%	66.6	259%
Mar-09	12.6	143.1	34174	100%	100%	86.4	112%	41.4	91%	140.9	105%	56.8	106%	64.1	249%
Apr-09	29.8	141.1	33508	99%	98%	83.6	109%	42.9	94%	133.4	99%	51.8	97%	18.6	72%
May-09	15	142.2	33468	99%	98%	81.1	105%	43.2	95%	133.4	99%	52.3	98%	0.1	0%
Jun-09	18	150.9	35370	106%	103%	83.3	108%	46.4	102%	139.5	104%	53.3	99%	0.2	1%
Jul-09	22.4	151.4	35400	106%	104%	81.6	106%	40.2	89%	134	100%	54.5	102%	0.5	2%
Aug-09	38	126.7	29903	89%	87%	66.5	86%	38.1	84%	119.1	89%	49.9	93%	0.4	2%
Sep-09	51.2	94.1	22200	66%	65%	108.9	142%	80.1	176%	163.4	122%	56.9	106%	0	0%
Oct-09	84.8	252.8	59425	177%	174%	76.6	100%	49.8	110%	125.9	94%	67	125%	0.7	3%
Nov-09	44	152.7	36012	107%	105%	58.7	76%	44.1	97%	126.1	94%	148.3	277%	4.5	18%
Dec-09	50.2	152	36127	106%	106%	77.9	101%	44	97%	132.4	99%	66	123%	0.6	2%
Jan-10	33.2	138.2	32364	97%	95%	85.7	111%	46.4	102%	129.1	96%	59	110%	1.7	7%
Feb-10	91	168.7	38611	118%	113%	90.7	118%	51.3	113%	133	99%	64.6	121%	7.2	28%
Mar-10	44.6	156.3	38870	109%	114%	88	114%	46.3	102%	143.6	107%	63.7	119%	2.9	11%
Apr-10	18.4	144.5	31548	101%	92%	74.7	97%	46	101%	119.9	89%	54.3	101%	0	0%
May-10	68	149.8	34791	105%	102%	87.9	114%	44.5	98%	129.8	97%	56.1	105%	1.1	4%
Jun-10	42	172.5	39731	121%	116%	85.1	111%	60.8	134%	152.5	114%	54.7	102%	0.8	3%
Jul-10		-3375.6	-9294160	-2361%	-27174%	-2230.5	-2901%	-6894	-15185%	-3431.1	-2559%	-5230	-9757%	-20059.5	-78053%
Aug-10		0	0	0%	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Figure 2: ***Example of stormwater / sewer infiltration data***

5.0 CURRENT WORKS

A number of proactive sewer maintenance programs are being trialled for comparison for operational and cost effectiveness, for example, routine block sewer cutting vs manhole inspections vs root foaming. Results of all of these trials will be tracked using CCTV inspections and data gathered concerning future / repeat blockages and rate of regrowth / intrusion of tree roots. The cost benefit of these procedures will be assessed along the lines of (for example) how long does it take for tree roots to re-invade the sewer after root foaming vs not root foaming? If you can clear / prevent 80% of blockages with a manhole inspection program, is it worth the additional labour / cost to find 100% of them with a block cutting program? etc etc. The EGW Geographic Information System (GIS) will be used to track the progress of these programs – already problem sewers (repeat blockages) are highlighted on the GIS and, in the near future, the Asset Management System – Conquest – will be used to develop routine maintenance programs and record information such as manhole condition and frequency of root cutting / foaming etc.

A specialist Sewer Maintenance Team has been formed to undertake both reactive and proactive responses to sewer issues such as blockages and spills. This team undertakes scheduled maintenance activities such as block sewer cutting, gathering visual data via a dedicated CCTV unit, smoke and dye testing (in suspected infiltration areas), routine manhole inspections, relining and replacement works. They are also involved in investigating and resolving issues that arise, for example, repeat sewer blockages and infiltration issues.

Below are examples of the sewer maintenance team and operations staff undertaking various proactive maintenance programs and investigations. Clockwise from left: smoke testing for infiltration at Dinner Plain, camera investigation / inspection of sewer main, example of root mass extracted from pipe, maintenance crew and sewer rodding

Examples of root masses removed from manholes (above) and some of the tricky situations (right) that can occur when undertaking repairs!

6.0 RESULTS

As a result of all of the proactive maintenance, increased training and awareness, efficient use of existing resources and application of appropriate equipment and technology, EGW is now more responsive to customer service requirements and expectations as well as becoming more compliant with ESC KPIs. Table 2 below shows the number of blockages per 100 km is now well within the EGW / ESC targets as well as nearly 50% below the Industry Average Target – compared with the poor figures shown in Table 1.

Table 2: ***Current ESC KPI results***

Essential Services Commission Operational Service standards 2009/2010.					
Sewerage	Units	EGW YTD Result	EGW YTD Target	EGW Full Year Target	Industry Average Target
Sewerage blockages	per 100km	15.51	18.90	18.90	29.48
Average time to attend sewer blockages	minutes	26.68	30.20	30.20	40.71
Average time to rectify a sewer blockage	minutes	85.52	76.90	76.90	136.92
Spills contained within 5 hours	per cent	1.00	1.00	100%	91.77%
Customers receiving 1 sewer blockage in the year	number	103.00		98	not available
Customers receiving 3+ sewer blockages in the year	number	0.00		0.00	13.23
		Equal to, or better than, YTD Target		Exceeded YTD Target	

7.0 CONCLUSION – LOOKING FORWARD

The collection of accurate data will enable East Gippsland Water to compare the success or otherwise of the various proactive maintenance programs that have been, and will be, undertaken. We will be able to assess the effectiveness of root cutting vs non-root cutting, a manhole inspection program vs a block cutting program and root foaming vs root cutting programs. The secret to a successful proactive maintenance program lies with the gathering of accurate data and the assessment of that data over time. New / alternative methods will be trialled over time – alternative root foaming methods, grease deterrents, spot root foaming for house branch issues etc – and compared with the more traditional approaches.

To date, this data has enable the more effective deployment of resources (time / labour / money) with the result that the sewer network is more reliable and effective as well as becoming 100% compliant with ESC Customer Service and Reliability KPIs.

Happy customers, happy operators, happy Board and happy regulators!!