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NSW Sewer Overflow PRP100 Reports Drive Asset Management Improvements

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ABSTRACT

All licenced sewage treatment systems (STS) in NSW are subject to the requirements of the Pollution Reduction Program (PRP). Under this program water utilities and Councils in the state are required to prepare Sewer Overflow Investigation Reports for each of the STS's under their management. The Councils who have used the compliance reporting to their advantage have experienced many improvements in the way they monitor and respond to the performance of their sewerage networks.

This paper will present the outcomes achieved by Bega Valley Shire Council from completing their PRP100 reports. The paper will summarise the management actions identified to lower the environmental and public health risks posed by sewer overflows. It will detail the various initiatives developed to reduce the likelihood of overflows including the use of preventative maintenance and system augmentation works. It will show how the targeted preventative maintenance is also improving customer service and delivering cost savings to the Council. The improved rigour in recording and reporting the condition and performance of the sewer networks has also driven improvements to the asset information and asset management systems which will be outlined within the paper.

INTRODUCTION

In 2003 the then NSW EPA (now Department of Environment Conservation and Climate) DECC, introduced new conditions to all Sewage Treatment System (STS) licences. These conditions included the requirement to prepare a PRP 100 Sewer Overflow Investigations Report by 30th June 2007. This paper presents the investigation undertaken and the outcomes achieved by Dubbo City Council and Bega Valley Shire Council in completing their PRP100 reports.

In preparing the sewer overflow investigations reports Dubbo and Bega Councils have used regulatory compliance to their advantage to integrate improved system knowledge with proactive management practices to lower the incidence of failure and reduce the likelihood and resultant risk of sewer overflows.

NSW SEWAGE TREATMENT SYSTEM LICENCING REQUIREMENTS

All licensed sewage treatment systems are subject to the requirements of the Pollution Reduction Program (PRP) 100. The program requires the preparation of a Sewer Overflow Investigations Report, which examines the extent of sewer overflows from the reticulation system and treatment plant.

The Protection of the Environment Operations Act 1997 (POEO Act) states that licenses (and hence PRP 100s) are only required for:

> *Sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation systems) that have an intended processing capacity of more than 2,500 persons equivalent capacity or 750 kilolitres per day and that involve the discharge or likely discharge of wastes or by-products to land or waters.*

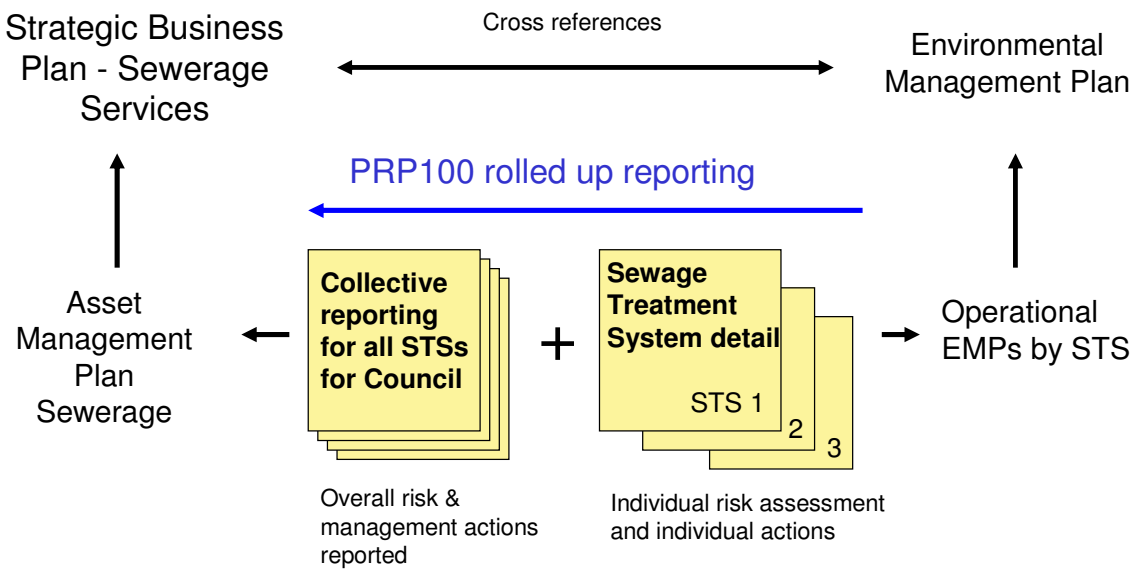
Dubbo required only one PRP100 report. Bega Valley has six licenced treatment systems. This Council decided to produce one single report with separate appendices for each treatment system which still enabled overall across the shire reporting.

WHAT IS A PRP100 SEWER OVERFLOW INVESTIGATIONS REPORT

The relationship of a PRP100 report to other corporate reports

Both Dubbo City Council and Bega Valley Shire Council have taken the view that as the PRP100 reports need to be completed for compliance for their STS licencing they should be of value to help identify and prioritise planned maintenance and system improvement works. To this end the outputs from preparing the PRP100 reports feed directly into the Council's sewerage system asset management plan and through this to the Strategic Business Plan as shown in Figure 1.

Figure 1 PRP100 Sewage Treatment System Reporting



In addition to asset management issues the management actions identified from preparing the system based overflow investigations reports are reported within the Council's Environmental Management Plan (EMP) in detail by system and collectively across the municipality.

The asset management and operational or system EMPs are regularly updated as system performance or asset condition data is collected and updated in the asset information systems. This enables council to respond directly on local issues as they arise. The Strategic Business and Environmental Management Plans are updated annually to update the 4 year operational expenditure programs. Consequently the PRP100 reports are integral to ensuring the most recent management actions address the risk of sewer overflows.

Contents of the PRP100 reports

Dubbo City Council and Bega Valley Shire councils have used the guidelines published by the DECC in preparing their PRP100 reports. The criteria from the guidelines for assessing likelihood of sewer overflows occurring, their impact to public health and the environment and the categorisation of risk have been followed. The analysis has occurred at two levels, the first at point locations in the sewerage system where either a designed emergency relief structure has been constructed or where the sewer hydraulic models (where built and calibrated) have simulated overflows to occur at manholes within the network under design wet weather events.

The second level of analysis is at a catchment level where the incidence of sewer chokes may lead to a sewer overflow. The difference with sewer chokes is that the location of the choke and overflow may occur at any number of manholes throughout the catchment. For this analysis the Councils have considered the likelihood from historical choke records and the impact at a catchment level.

The format of the PRP100 reports follows the template shown over.

COLLECTIVE REPORTING OF STSs

- Introduction to process and licencing
- Overview of all systems
- Information systems & data used
- Profiles of all STSs
- Likelihood of overflows during dry weather
- Likelihood of overflows during wet weather
- Public health and environmental impacts of sewer overflows
- Risk of sewer overflows
- Management actions to address sewer overflow
- Works programs

INDIVIDUAL STS REPORTING

- Profiles of the STS
- Likelihood of overflows during dry weather
- Likelihood of overflows during wet weather
- Public health and environmental impacts of sewer overflows
- Risk of sewer overflows
- Management actions to address sewer overflow
- Works programs

With reference to Figure 1 the performance and sewer overflow risk assessment is determined at a local level and aggregated up as a system wide report.

BENEFITS IN PREPARING THE SEWER OVERFLOW INVESTIGATIONS REPORTS

This paper will not focus on the process of overflow risk assessment or the generation of the opex and capex work programs. The purpose is to focus on the benefits to a Council from rigorously addressing the requirements of the reports and using the outputs of the effort to improve the way the Council manages its sewerage systems. The five key benefits in no particular order consist of:

1. Improved asset information and asset condition/performance knowledge
2. Improved asset information management systems
3. Improved business productivity and effectiveness
4. Improved customer service
5. Improved environmental management

Improved asset information and asset condition/performance knowledge

Sewage overflows can occur due to a variety of reasons. Examples are shown in Figure 2.

Figure 2 Causes of sewer overflows

Collapse of a pipeline causing surcharging and spill of untreated wastewater

Source: WSAA Compendium sewer defects

Choke or blockage of a pipeline caused by tree roots, debris or fat

Source: WSAA Compendium sewer defects

Inability of the sewerage network to cope with the increase in flows occurring during wet weather when rainfall derived inflow and infiltration enters the system

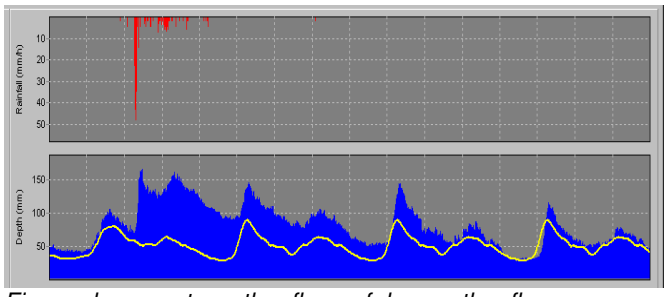


Figure shows wet weather flows cf dry weather flows

Photo courtesy Bega Valley SC

The failure of mechanical or electrical assets where standby equipment either does not operate or lacks capacity to handle the sewage flows within the system

Photo courtesy Dubbo CC – Troy Junction STP

Preparing the PRP100 report requires the likelihood of sewer overflows to be investigated under the two scenarios of:

- Overflows occurring during dry weather caused by system failures such as collapses, chokes and pump station equipment failure i.e. system reliability; and
- Overflows simulated to occur if a theoretical storm event of a certain return period and duration occurs i.e. system wet weather performance.

The work to assess likelihood of overflow cannot be effectively carried out without the knowledge of chokes and other system failures. Records are required to be held by Council of sewer overflows for STS licence compliance purposes but they typically do not differentiate between dry and wet weather causes as above. The preparation of the trend graphs of performance and the relative performance across the licenced systems is important in developing the management actions.

Improved asset information management systems

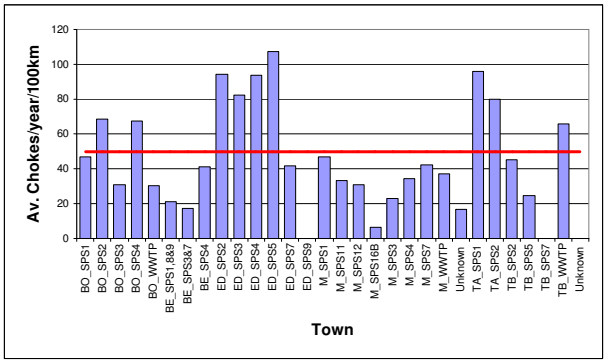
If Councils have not already commenced recording system failures and records of overflow into a database for display via their GIS of the sewerage network then the task of preparing management actions to reduce the likelihood of sewer overflows is going to be difficult. The value of linking condition knowledge and performance history to assets through the GIS is significant comprising:

- Comparison of failure rates between catchments of a STS and between STSs. This facilitates the prioritisation of asset condition monitoring, maintenance and renewal works;
- Identification of individual assets that require more detailed investigation to assess whether more permanent measures such as renewal over cleaning are required to manage the incidence of overflows;
- Correlation of choke histories by category of pipeline eg. age, material, size etc to further refine management decisions on cleaning and/or renewal; and
- Recording of management action decisions to the asset elements such as pipelines to generate the detailed 4 year operational programs of work and the longer term capital renewal forecasts.

The two Councils discussed in this paper Dubbo City Council and Bega Valley Shire Council have utilised an ESRI ArcView GIS and a MapInfo GIS respectively linked to an MS Access database to record and display asset performance and the opex and capex works programs. The advantage of using "*off-the-shelf*" products is that they are relatively easy to use and can be purpose configured to meet the recording and reporting required for the PRP100 report, the asset management plans, the Strategic Business Plans etc. Examples of the output from using the systems are shown in Figure 3.

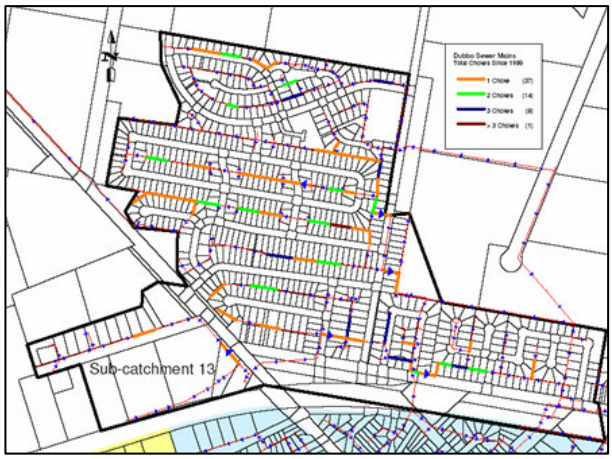
Figure 3 The value of GIS and database linked systems for PRP100 report preparation

Sewer chokes by catchment - Bega Valley SC



Source: Bega Valley SC PRP100 Report

Reliability assessment by pipeline – Dubbo CC



Source: Dubbo CC PRP100 Report

Improved business productivity and effectiveness

In preparing the PRP100 reports Councils have to identify the likelihood of sewer overflow and the consequences to public health and the environment for all point source locations of overflow. These comprise designed overflow structures, sewage pump stations and maintenance holes. In the case of maintenance holes the risk assessment would be carried out where there is a regular discharge of sewage during wet weather when the sewer system surcharges or when the calibrated hydraulic model simulates this overflow under certain design or historical storm conditions.

It is the level of assessed risk which drives the prioritisation of management actions throughout an STS or across a number of STSs. The overflows with the highest impact need to be rectified or controlled first. The improved productivity and effectiveness is achieved by developing targeted works programs to reduce the high and significant risk locations to moderate or low risk. For example a generalist inspection and fault rectification program of private and public sewer connections across an STS to try and reduce inflow and infiltration is not going to be as effective as planning, designing and constructing wet weather detention storage and pump station augmentation works or other flow management measures. Costs may be higher for large scale projects but the value of the calibrated hydraulic models will be in knowing that the constructed works will do their job in reducing overflows.

Figure 4 Examples of capacity augmentation to manage wet weather flows

Wet weather flow storage cells under construction for City West Water

Photo courtesy City West Water

Wet weather flow storage tank under construction at Sewage Pump Station

Photo courtesy Yarra Valley Water

Sewer overflows can also be minimised by improving the reliability of the system to convey flows during normal or dry weather conditions. By keeping the network relatively free of chokes or collapses and mechanical or electrical failure will lower the risk of overflows because the likelihood will be reduced. As the location of a system failure cannot be accurately pre determined for these failures the use of historical performance data for a catchment of an STS will facilitate the works programming of asset inspection, cleaning, repair or renewal.

Bega Valley Shire Council and Dubbo City Council both use a risk based renewal forecasting model to prioritise their asset inspection and asset renewal works. The model uses all available knowledge on asset condition and performance such as chokes and collapses to determine the likelihood of failure. When this is combined with the consequences of failure (comprising public health and environmental impact) a level of risk is defined for the asset and a corresponding management action is applied and captured within the asset information system. Figure 5 shows the model's application to Dubbo CC's pipeline and non-pipeline assets.

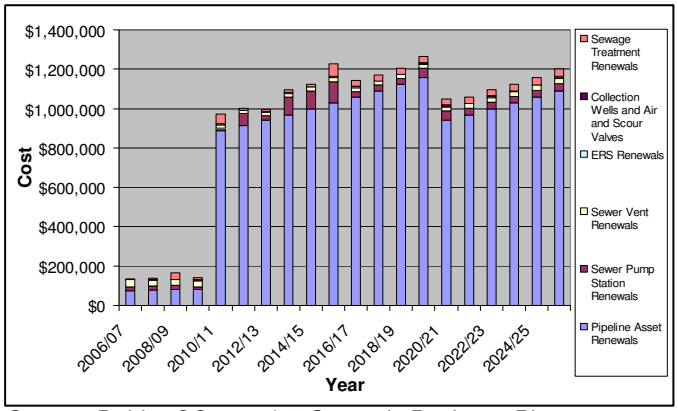
Figure 5 Risk based asset inspection and renewal planning model

Dubbo CC's risk based renewal decision support matrix

CONDITION Expected Remaining Useful Life	CONSEQUENCE RATING			
	AAA Extreme Consequence	A High Consequence	B Moderate Consequence	C Low Consequence
5 (<1 yr)	**CMW or Replace Immediately**	**CMW or Replace within 1 year**	CMW or Replace 1-4 yrs Inspect every year	CMW or Replace 1-4 years No inspection
4 (1 to <5yrs)	**CMW or Replace within 1 year**	CMW or Replace 1-4 yrs Inspect every year	Replace in 5 –10 years & Inspect every 2 years	Inspect every 2 years
3 (5 to <10yrs)	CMW or Replace 1-4 yrs Inspect every year	Replace in 5 –10 years & Inspect every 2 years	Inspect every 2 years	Do Nothing
2 (10 to <20yrs)	Replace in 5 –10 years & Inspect every 2 years	Inspect every 2 years	Do Nothing	Do Nothing
1 (≥20yrs)	Inspect every 2 years	Do Nothing	Do Nothing	Do Nothing

Source Dubbo CC Asset Management Manual

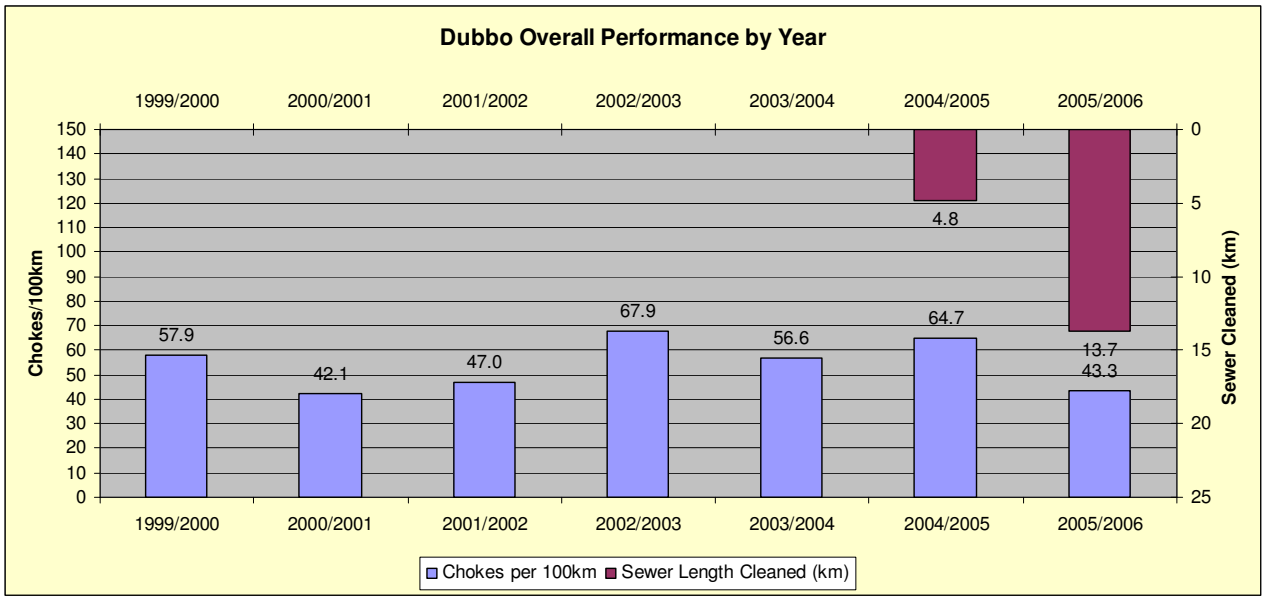
Dubbo CC's asset renewal forecast



Source Dubbo CC 2006/07 Strategic Business Plan

Further business efficiencies can be achieved through targeting sewer cleaning programs to the locations of high numbers and rates of sewer chokes as displayed in Figure 3. By routinely cleaning catchments with the highest rate of blockages it is expected that sewer choke rates will decline as experienced by Dubbo CC and shown in Figure 6.

Figure 6 Impact of targeted cleaning on sewer choke rates at Dubbo CC



Chokes occurring repeatedly on the same pipelines will be picked up under the risk based renewal forecasting model and included on a renewal program.

Improved customer service

Figure 6 demonstrates how a sewer cleaning program can reduce the incidence of a choke and the potential for a sewer overflow. By its nature this proactive maintenance strategy is directly improving the level of service to the Council's customers.

Preparing the PRP100 reports also identifies a management action or program to improve the time to rectify sewer faults should they occur and minimise the disruption to any affected customers. The sewer overflow risk assessment prioritises catchment based sewer cleaning and individual pipeline inspection and/or renewal. However should a choke or collapse occur prior to intervention it is important that the cause of the problem can be quickly identified, rectified and the service restored. To this end any maintenance holes accessing the sewer should be accessible and in acceptable condition for entry if necessary. Maintenance holes in high risk catchments and on high "*risk of failure*" pipelines should be inspected and maintained to minimise search time by maintenance staff and service restoration times. A couple of examples of real field conditions are shown in Figure 7.

Figure 7 Examples of maintenance holes which could pose problems in accessing and clearing faults

Potential problems with access for maintenance Maintenance hole next to building will be behind

equipment

Photo courtesy Bega Valley SC

locked gates after normal hours

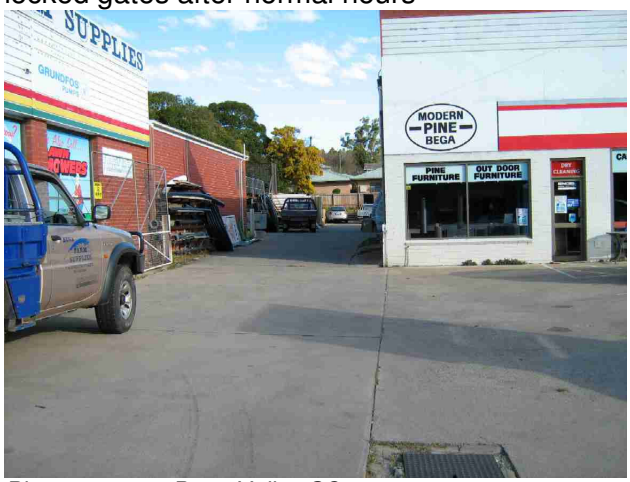


Photo courtesy Bega Valley SC

Improved environmental management

The PRP100 report identifies the management actions to reduce the likelihood and therefore the risk of sewer overflows occurring in the sewage treatment systems. With the implementation of the operational and capital works the expectation is that overflows will reduce in number and severity. By their nature the PRPs become a valuable management tool to lessen the threat to the environment.

CONCLUSIONS

The process for preparing PRP100 sewer overflow investigation reports identifies the risk to the managing utility of sewer overflows occurring in dry weather and wet weather conditions. They quantify the risk at potential overflow locations and in areas of the sewage treatment system where the likelihood of failure is high.

The PRP100 reporting drives improvements to the process for accumulating condition and performance knowledge of the assets. The process also fast tracks improvements to the systems for recording and reporting that knowledge which in turn also improves business efficiency.

RECOMMENDATIONS

All Councils should embrace the development of the PRP100 reports. They should not be seen as simply as a compliance document, rather a tool for the development of operational and capital works programs that improve system reliability, improve customer service and lessen the risk to public health and the environment. The investigation process applied in developing the reports is best practice and work that should be undertaken in day to day asset management of the sewerage service.

The PRP100 reports should be kept up to date and reviewed annually to ensure the management actions presented in the annual strategic business plan are current.

REFERENCES

1. AS/NZS 4360:2004 Risk Management
2. NSW EPA Licencing Guidelines for Sewage Treatment Systems, July 2003

Biography of the Author

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Max is a civil engineer with over 33 years experience in the water industry. He has worked with Melbourne Water, the Public Works Department of WA and Earthtech. He has been employed with MWH Australia for the past 9 years.

Max's primary areas of expertise comprise water supply, sewerage and stormwater drainage asset management with an emphasis on the .development of short and long term maintenance and asset renewal programs. Max's interest is to facilitate change in the way water utilities and councils undertake their forecasting and determine their long term capital works plans. His endeavour is to change the thinking of many utility managers from that of managing assets to managing a service for their community. Max is currently providing a knowledge leader role in strategic asset management to all of MWH's Australian offices.