

THE OPERATION AND MAINTENANCE OF PRESSURE SEWER SYSTEMS



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ABSTRACT

'us' - Utility Services has been operating and maintaining pressure sewer systems for South East Water Limited since 2001. The pressure sewer systems had advantages over traditional gravity sewers in some instances – for example, flat topography with high water tables – in that construction would be shallow with minimal environmental disturbance. However, we had little experience with the operation and maintenance of the pressure sewer systems at the early stages.

Through a process of continual improvement, 'us' - Utility Services has “ironed out” the initial problems with the pressure sewer systems, and we are now confident that they are a viable alternative to gravity sewers.



1.0 INTRODUCTION

'us' - Utility Services is a strategic alliance between three innovative and service oriented companies that are recognised as leaders in their industry sectors – *South East Water, Thiess Services and Siemens*.

The alliance provides a broad range of utility, construction and maintenance services, including maintenance and operation of South East Water's sewerage system. This includes over 230 sewage pumping stations, and more than 7,800 kilometres of reticulation sewers.

In 2000, South East Water was assessing the options for providing backlog sewerage to the coastal township of Tooradin. The flat topography and high water table made construction of a traditional gravity sewer system expensive and potentially environmentally damaging. Consequently, South East Water opted for a pressure sewer system to service Tooradin.

With the pressure sewer system, each property is provided with a small tank with a pump unit installed to which all their household wastewater is diverted. The tank fills and when a certain level is reached the pump unit is activated (pumping waste out of the property) and the level reduced to a point where the pump stops.

The design of the pressure sewer system means that smaller diameter pipes are used, at shallower depths, so the impacts of constructing the system are less than a gravity system sewer.

Since the initial installation at Tooradin, South East Water has installed pressure sewer systems to service Cannons Creek and Warneet. In 2007 construction began on a major pressure sewer system at Flinders.

'us' - Utility Services has been operating and maintaining the pressure sewer systems on behalf of South East Water since 2001. During this time we have used several different pump arrangements, and experienced a broad range of issues peculiar to the pressure sewer systems.

Gary Grogan is one of 'us' - Utility Services Sewerage Operations Coordinators, with over 20 years experience working with water and sewer pumps and valves. He has been extensively working on the pressure sewer systems since their inception, and was involved in identifying and implementing improvements to the original designs. In this paper, Gary will give examples of our experiences and describe how we have managed to get the optimum performance from our pressure sewer systems.

The paper will detail the:

- Challenge, cooperation and resolution to improve the operation and maintenance of the service; and
- Anecdotes and stories from the operator's view as part of the presentation delivery.



2.0 DISCUSSION

2.1 Pump Maintenance

The pumps come with a life expectancy of 20 years, and are supposed to require minimal maintenance. However, we have identified a number of issues that required some close attention and needed to be addressed, including:

- Pump blockages;
- Stator/Line failure;
- Discharge hose failure;
- Failed pump housing;
- Faulty motor assemblies;

- Control box failures;
- Pressure switch;
- Power supply;
- Pump fittings corroded;
- Inadequate capacity;
- Consumer awareness / disregard
- False alarms; and
- Vandalism.

2.2 Pump Operational Considerations

Installation of the pressure sewer pumps requires staff for both mechanical and electrical components.

The pumps weigh more than 20 kilograms, and therefore cannot safely be lifted by just one person.

The pumps had Brown Out Protection installed. This was effective in protecting the pumps, but has caused a number of high level alarms.

Need to keep a number of spare parts readily available. '**us**' - Utility Services has created a store at a nearby sewage treatment plant for the parts, and also developed a maintenance trailer that carries sufficient tools and spare parts to remove and replace a pump unit.

2.3 System Operations

There have been a relatively low number of problems with the pressure sewer pipeline system itself. However, some key lessons learnt were:

- Carefully choose the types of fittings for:
- Tapings
- Valves and
- Couplings
- Ensure the materials are appropriate:
- There has been corrosion issues with brass fittings and
- Some PVC fittings have had failures.

2.4 Boundary Assembly Failures

Some boundary assembly units failed shortly after installation due to poor material quality or not observing the correct installation procedure.



2.5 Tapping Saddle Failures

These tapping saddles were fusion welded, which should have ensured a permanent join. However, we found that the fusion welding can fail if not done correctly to start with. Since then we have developed a policy not to allow fusion welded saddles for repairs, giving the difficulties of achieving a good weld in field conditions.



2.6 Other Repairs

Mainly associated with joints, valves and pump seating as pressure will quickly find the weakest link in the system and any rectification work is a direct loss, in addition to the inconvenience caused for the customer.

Therefore, do it right first time and double check.



2.7 System Shutdown

Occasionally there is a requirement to take the system or individual pump off-line. In general that happens:

- During system maintenance, or
- Pump Shut off through Thermal Overload protection not being as effective as planned

- “Over pressure protection” (controlling device now used in new design, ECO 1-60).

To accommodate such System Shutdown consideration is to be given based on:

- Require eductor truck to be connected to flush point; OR
- Shut off each individual pump

2.8 Odour Management

- Calcium Nitrate Chemical Dosing
- No Odour Issues at Treatment Plant
- Odour issues at air valves locations on rising main
(only ground vents at air valve locations)

Air Valves shut off due to Odour complaints

- Is rather flat terrain
- Air Valve shut off, with negligible effect to system

2.9 Current Call-Out Process

Local Alarm (at residence) triggers at tank high level

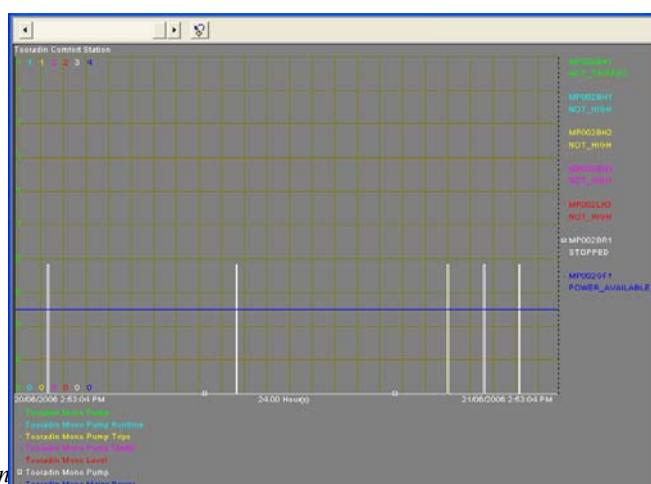
- Tanks have ~ 24 hours storage
- Out of Hours (if not spilling) next day response

False Alarms

- Have experienced many “false alarms”, caused by:
 - Thermal Overloads during power outage recovery
 - Partial (difficult) blockages
 - Brown Out Protection
 - Time delay for pumping out after power outage
- Definite need to educate customers and Call Centre staff
- Call Centre staff generally ask customer to call back if unit is still alarming after one to two hours

2.10 Future Operations and Maintenance Improvements

- Remove customer interface to PSS pump operation by usage of telemetry
- Communications via low power radio to control panel
- Linked to SCADA system through base station located within towns
- Operations staff able to obtain pump unit info remotely for diagnosis
- Increase ability to monitor system performance centrally
- To be used for “global shutdown” during system failure for controlled start up



3.0 CONCLUSIONS

3.1 Outcomes of Trials

With the experience gained over the last six years, '**us**' - Utility Services has been able to iron out the initial "bugs" it found when operating and maintaining pressure sewer systems. These include:

- Given that each customer must discharge through their individual pressure system pump, we are able to identify those who discharge inappropriate materials that may upset or block the system. For example, extra flows from pool backwashes, fats from cooking, toys and other objects, etc. After we have rectified the problem the first time we will put the customer on notice that if they cause any future blockages they will be charged for our costs.
- Telemetry alarms and recording will be available on every individual pressure sewer pump. This will give us greater awareness of the operation of the system without having to rely on customer feedback.
- We will be able to turn off – and back on – all the pumps in a pressure sewer system. This is a major time saving improvement, and would assist during any major repair works.
- The system design of 24 hours holding capacity significantly reduces the possibility of spills. This exceeds our minimum holding capacity design standard of greater than 2 hours at standard pump stations, and eliminates the need for large and expensive holding tanks at the main outfall pumps.
- The design of the pressure sewer pumps and pipes effectively eliminates any requirements for confined space entries. This reduces time taken to undertake repairs, and also eliminates a major potential cause of OH&S incidents. In addition, there is no need for fall from heights restraints as the pumps and pipes are shallow.
- Re-designing the pressure sewer pumps so that they sit in a "dry well" above the inlet chamber makes routine pump maintenance and repairs much cleaner and quicker. It also prevents the pumps being fouled with fats, as happened previously when they were in the "wet well".

3.2 Where to From Here?

Given the improvements that have been made to operating and maintaining the pressure sewer systems, '**us**' - Utility Services is now much more comfortable that this system offers a valid, efficient and effective alternative to traditional gravity sewers. Given the initial advantages that pressure sewer systems have in regard to lower construction costs and reduced environmental impacts, we believe that the use of pressure sewer systems will increase throughout both South East Water's area and that of other water authorities.

4.0 ACKNOWLEDGEMENTS

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