

Wastewater treatment

The SEWPUMP tool

A practical software tool has been developed as a training and communication tool to mitigate against pump station problems.

Background

Pumps are essential components in most sewer systems and are often considered by operators and managers to be the most problematic. This WRC project set out to address a number of pertinent issues with regards to sewage pumps, pump stations, and related elements of sewer systems.

South African sewer systems and storm drainage systems are designed as separate systems. The sewer is traditionally waterborne. Waterborne sewers or conventional sewers use water as the mode of transport for excrement and other waste.

This research project focused exclusively on separate waterborne sewers and specifically on decentralised sewerage pump and related infrastructure in the piped sewer system.

The issue at hand extends beyond hydraulics and design criteria to enable stakeholders to decision support and communication. The aim was to link decisions to problems occurring at sewage pump stations during normal operating life, after commissioning.

One of the key issues addressed by this research and the subsequent software tool revolves around improved knowledge transfer and communication between different levels of technical staff involved with sewerage pumps.

Sewage and solids

Sewers operate over a wide range of flow rates and the

limiting values need to be taken into account when evaluating how effectively a sewer will transport solids to a pump station. Effluent velocity at the various flow rates is the most significant factor influencing the transport of solids through a sewer.

The content and relative contribution of solids type to the total solids varies from one catchment to another, and is influenced by the flow rate in various ways. The solid load by mass for industrialised countries has been reported to vary between 100 mg/ℓ and 500 mg/ℓ for sanitary solids and between 50 mg/ℓ and 1 000 mg/ℓ for stormwater solids.

A distinction needs to be made between the solids that can be transported through a sewer in terms of their specific gravity relative to that of the effluent, whether or not they will disintegrate with time and their impact on the operation and life of pumps.

As the clogging of pumps by material that had a specific gravity similar to that of the effluent was a problem and little literature on the subject could be found, a series of laboratory experiments was done to determine the effectiveness of screening baskets in removing these materials. Recommendations for the location of screening baskets relative to the effluent levels in the sump where they are to be placed were made and the need for further research in this regard was noted.

Problems and causes

Identifying, listing and classifying the problems and how the measurement of the intensity or extent would be quantified

was a particular challenge faced by the research team. A clear distinction needs to be drawn between problems and their causes.

If the underlying causes are not identified and addressed; the problems will keep occurring. This study could be considered as one addressing problems (direct) versus the underlying causes (indirect).

Sewer pump station problems were ultimately categorised into four classes. Each direct problem identified in the first phase of the project could ultimately be placed into one (or more) of these four problem classes, based on a degree of membership to each class. In presenting the framework here, aspects regarding roles and responsibilities were not included, so as to maintain the focus.

These arrived at were coined the 4 'O's of sewage pump station problems, namely overflows, odours, operation and (maintenance), other.

Stakeholder workshop

A workshop titled 'WRC – Practical application of research: A tool for sewer pump problems' was held during the 2012 Biennial Conference of the Water Institute of Southern Africa (WISA). A total of 28 delegates participated actively in the workshop.

The approach was to gain an in-depth understanding of the participants' views regarding sewer pump problems and the software tool. The delegates discussed various aspects of sewer pump problems, pump stations, and the intended tools developed as part of this study. The feedback from the workshop was incorporated into the final development of SewPump.

The SewPump tool

SewPump is aimed at providing information regarding sewer pump problems. The tool was developed to act as a visual aid for staff involved with the operation and management of sewerage pump stations, thus providing useful information in a structured and convenient way.

It was clear that, with clever planning, SewPump could be used to cut through communication barriers between different staff levels, and it was extended to address that need.

A software developer was employed to develop an

html-based standalone software tool with the following three main focus areas:

- Identification: Help to understand and identify problems at sewer pump stations
- Communication: Facilitate communication between pump station operators and management.
- Training: Should transform to a training tool that could be used by individuals for self-study and by managers to facilitate training.

Conclusion

Two aspects need to be understood when referring to sewage pumping, namely the pump station (infrastructure and equipment) and the sewage stream to be pumped. This research project included a review of both these aspects.

It was concluded that both were well documented, based on former research. However, previous publications regarding solids in sewers and their behaviour were limited, particularly with regards to baskets that were found to be very common in local sewage pump installations. Limited laboratory tests were conducted to investigate the interaction between solids in sewage and screening baskets.

The tool that was developed as part of this project will aid operators with sewage pump problem identification so as to help understand and identify problems at sewer pump stations, facilitate communication between pump station operators and technical management, and provide for basic training regarding sewage pumping and related problems that can be used by individuals for self-study and by managers to facilitate training.

The outcomes of this project will aid a municipality and their engineering consultants to better understand the working of a sewerage pump station and the related problems. The expectation of a maintenance-free sewerage pump station should be replaced by empowerment.

Further reading:

To obtain the report, *Understanding Sewage Pump Stations – Development of a SEWPUMP Tool* (WRC Report No. TT 627/15), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.