

## Executive Summary

The project falls under the following administrative research structure of the Water Research Commission (WRC):

- Key Strategic Area 3: Water Use and Waste Management
- Thrust 3: Wastewater and Effluent Treatment Technology
- Programme 7: Sewerage Reticulation

## Summary of principal objectives

The WRC has solicited this project in order to identify key issues and develop appropriate research responses in the field of reticulated sewer infrastructure in South Africa. The project has been developed according to the following principal objectives:

- To identify and characterise the sewerage reticulation issues on the background of international and regional research work available from accessible databases.
- Prioritizing the sewerage reticulation issues requiring attention within the context of integrated urban water resource management in South Africa, and
- Developing strategic guidelines for dealing with above highlighted issues.

The findings of this project will form the framework for solicited projects and lead to a roll-out of focused research projects dealing with specific needs in the industry.

## Outline of work program

Information was collated through literature surveys and stakeholder feedback workshops to establish:

- The status quo of sewerage reticulation in South Africa;
- International trends and regional needs to facilitate the sewerage reticulation operation and maintenance as well as new developments;
- The direct impact of water demand management and other infrastructure on sewerage reticulation; and
- The research priorities and phasing for the WRC in facilitating the most urgent research projects.

By completing a series of workshops with local councils on the topic of sewer reticulation firstly established the concerns of managers and operators and, secondly, ground-truthed the need and priority of research topics identified during the literature survey process. The findings presented in this report form the consolidation of four project deliverables, namely:

- Local and international literature survey
- Status quo of sewer reticulation issues in SA
- First-order situational and gap analysis
- Final report consolidating the previous three items and developing a framework and guideline document indicating specific shortcomings regarding technical, operational and strategic issues and a prioritised roll-out of focused research needs and associated costs.

Although individual reports were produced for each of the above stages, the final report and electronic dataset has been structured to suite the target audience.

## **International and local literature surveys**

The initial literature search revealed over 5500 references to sewer related topics, of which 2021 pertinent international documents and approximately 113 local references were selected for further evaluation. These were further categorised and sorted into topics and sub-topics for ease of reference and reporting.

Although basic reticulated sewer systems have been in existence throughout the millennia, it is only since the mid 19<sup>th</sup> century that significant advances in terms of a holistic understanding of health, social, planning, design and operation of an effective sewer system have been researched, documented and implemented.

The literature survey, particularly international references, indicated noticeable trends in available research. More than fifty percent of all literature falls within the "Technical" category which deals with planning, design, construction, operation and maintenance of the sewer reticulation.

It must be noted that much of the international research is conducted on combined sewer systems and not separate sewer and stormwater systems which are prevalent in South Africa. However, many issues identified within the combined sewer systems resembling in principle the topics in the research which may be applicable to South African conditions.

All pertinent literature references have been compiled in a searchable spreadsheet format appended in CD-format to this report. Many listed documents in the spreadsheet could not be located or are out of print, precluding a detailed review.

## **Status Quo of Reticulation Issues**

A series of workshops were held at eight main centres throughout South Africa. The workshops were held in parallel with SRK Consulting who was completing similar needs analyses focusing on stormwater infrastructure issues. The intention to hold combined workshops was to determine interfaces between sewer and stormwater departments and establish a way forward by discussing and addressing common issues. A total of 21 metropolitan, local and district councils were represented at the sanitation working sessions.

The workshops accentuated the main constraint facing the management and operation of sewer reticulation systems in South Africa as being a lack of resources and to a lesser extent a lack of funding. The South African Institution of Civil Engineering reported in a recent study that 79 of the 231 municipalities did not have any civil engineers, technologist or technicians, and in general the country only has one engineer per 3200 people, a capacity that is far below internationally accepted norms.

The restructuring of local government structures during the municipal demarcation process and the posting of personnel to other departments has resulted in a loss of knowledge and operational background of how the original sewer systems were constructed and operated. Unfortunately such information has not been captured in suitable database or electronic systems and in many instances there is little as-built (or as recorded) information for much of the systems.

The serious loss in capacity and experience has resulted in the need for increased information dissemination and production of guidelines to assist managers in understanding the full

requirements of planning, designing, operating, and particularly maintaining and rehabilitating/upgrading of sewer infrastructure. With a host of available products, materials, software and methods employed in the various aspects of sewer management, the standardisation and setting of minimum requirements and guidelines will assist in ensuring that minimum levels of service are maintained, specifically in the smaller local authorities.

The research team has identified needs in the industry and established areas where new research is required, where completed research needs to be revisited and where there is a need to disseminate existing research to relevant professionals and administrators.

In terms of research needs, the greatest requirement from local authorities is to investigate and provide guidance in the fields of:

- Operations and maintenance;
- Environmental issues;
- Benchmarking; and
- Analysis of existing systems;

The following fields were considered least important for immediate research requirements:

- Further legislative requirements;
- Guidance on quality systems;
- New system construction;
- New technologies; and
- Safety

### **Date of research publication**

The date of publication of existing research papers has been considered in evaluating the relevance of a research publication in the survey of international and national literature. The earliest references considered for the literature study dated in the late 1960's. The bulk of the research publications available for evaluation have been grouped and presented in two fifteen year periods up to the year 2000. Very few international research publications were sourced for the post 2000 period. However, most of the relevant national research publications available are dated after the year 2000.

### **Gap-analysis priorities and actions**

A gap-analysis was completed as part of the project to categorise and prioritise research needs which had been identified during the previous phases of the project. The gap-analysis was also extended to document elements of sewer infrastructure research and management that were not specifically identified or dealt with during the literature survey and national workshops.

The gap-analysis identified 53 potential research topics for the Water Research Commission to consider further. These topics were consolidated into 31 projects and prioritised based on the needs identified during the national workshops. An additional 6 topics were identified, but it is felt that these

topics have been covered sufficiently under previous research projects and that dissemination of this research is required.

A comparison of coastal and inland local authority priority issues revealed that benchmarking and education were of greatest importance to coastal areas, whilst operational and maintenance and environmental issues concerned more professionals and administrators from the inland areas.

A comparison of smaller local and regional council, and larger metropolitan council issues revealed that operational and maintenance, and system analysis were of greatest importance, whilst the metropolitan council require additional research conducted on benchmarking, social and educational issues.

In general the metropolitan structures are well established with comprehensive systems, resource structures and functional bylaws and procedures. The smaller councils do not have the financial benefit of implementing enterprise-wide information systems or the personnel capacity to manage water service systems. The majority of time is typically spent on keeping the existing sewer system operational with little planned routine maintenance or master planning.

### Project outcomes

- A list of 31 prioritised research projects have been identified under this study for further consideration by the WRC. Durations and budgets have been allocated for each of the projects, however the scope of the projects, budgets and durations should be assessed further by the WRC to ensure that they adhere to their overall research and funding strategy at time of implementation.
- The project established the terms of reference for two solicited research projects to be implemented immediately in the field of fundamental research (*Improving Sewerage for South Africa*) and applied research (*Sewer Master Planning Tools and Guidelines*)
- Along with these projects there is a need to develop national standards in the field of buried flexible pipes, jointing systems and trenchless technologies along with national standards bodies.
- There is currently limited funding allocated for research and development on sewer networks, which should be reviewed and addressed by the WRC in conjunction with national and local government, standards bodies and organisations associated with the sewerage industry.
- There is also a need to address the dissemination programme of available information to the industry for valuable research that has been conducted by the WRC and other organisations.

## Acknowledgements

The project team wishes to express its appreciation to the Water Research Commission for its financial support and to the following organisations and individuals for their valued input and comment.

**Table 1: Project Team**

Name	Company/Organisation	Role
Brian de Swardt	IUI	Project Manager/Sewer Facilitator
Bo Barta	IUI	Senior Researcher/Reviewer
Nicola Avian	IUI	Research Assistant
Jay Stathakis	IUI	Technician/Data Management
Brett Mansfield	IUI	Student/Data Capture
Edson Rhumhizha	IUI	Student/Review
Jean de Swardt	IUI	Secretary
Matt Braune	SRK	Stormwater Facilitator
Xanthe Mayer	SRK	Workshop Co-ordination
Jackie Burke	SRK	Project Liaison

**Table 2: Reference Group**

Name	Company/Organisation
Dr Heidi Snyman	Water Research Commission (Chairperson)
Prof Neil Armitage	University of Cape Town
Mr Charlie Crawford	Department of Water Affairs and Forestry: Water Services: Technical Innovation Guidance
Mr Anton de Klerk	University of Pretoria
Mr John Harrison	eThekweni Municipality: Planning
Mr Nigel Ireland	City of Cape Town: Water Services: Sanitation
Mr Leon Naude	East Rand Water Care Company (ERWAT/IMESA)
Ms Valitha Roos	Johannesburg Water: Operations Manager

The project team wishes to acknowledge the time and input offered by all attendees at the workshops. A full list of attendees is included in Annexure B: National Audit of Sewer Reticulation Issues. The success of the workshops is attributable to the lively discussion, feedback and interest shown in the project by the attendees, for which the project team wishes to offer their heartfelt thanks.

## Structure of Report

The structure of the final report comprises the text report and a data CD compiled as follows:

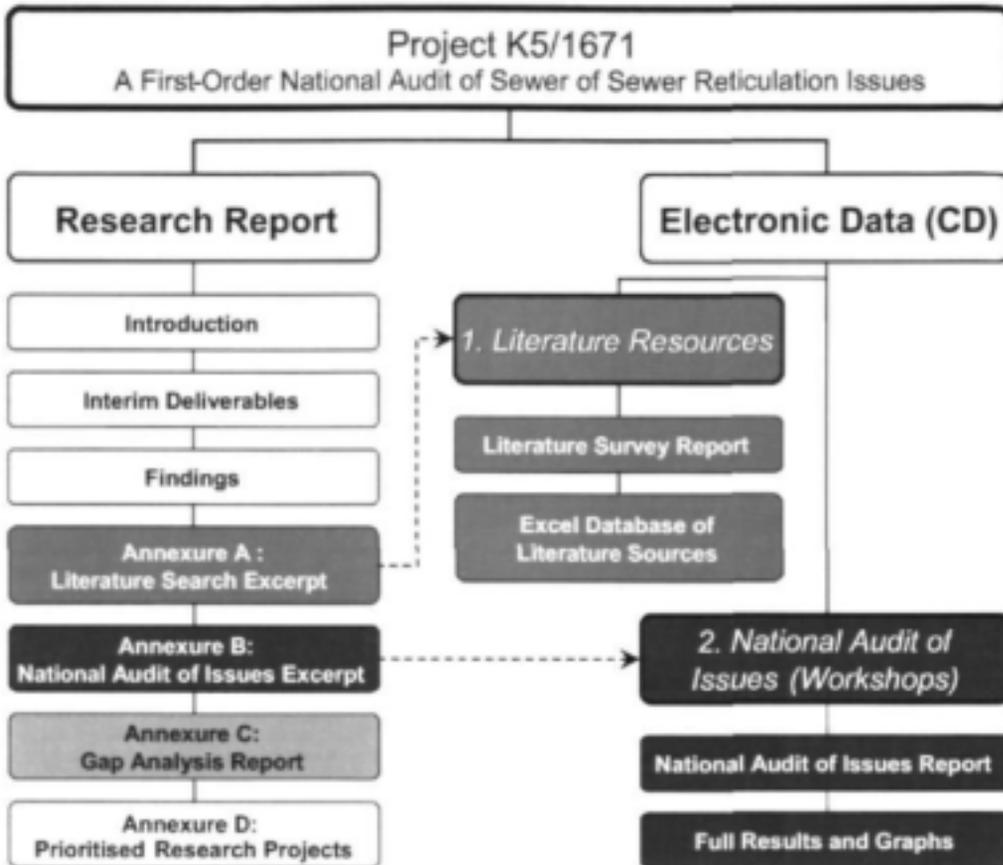


Figure 1: Structure of Research Report