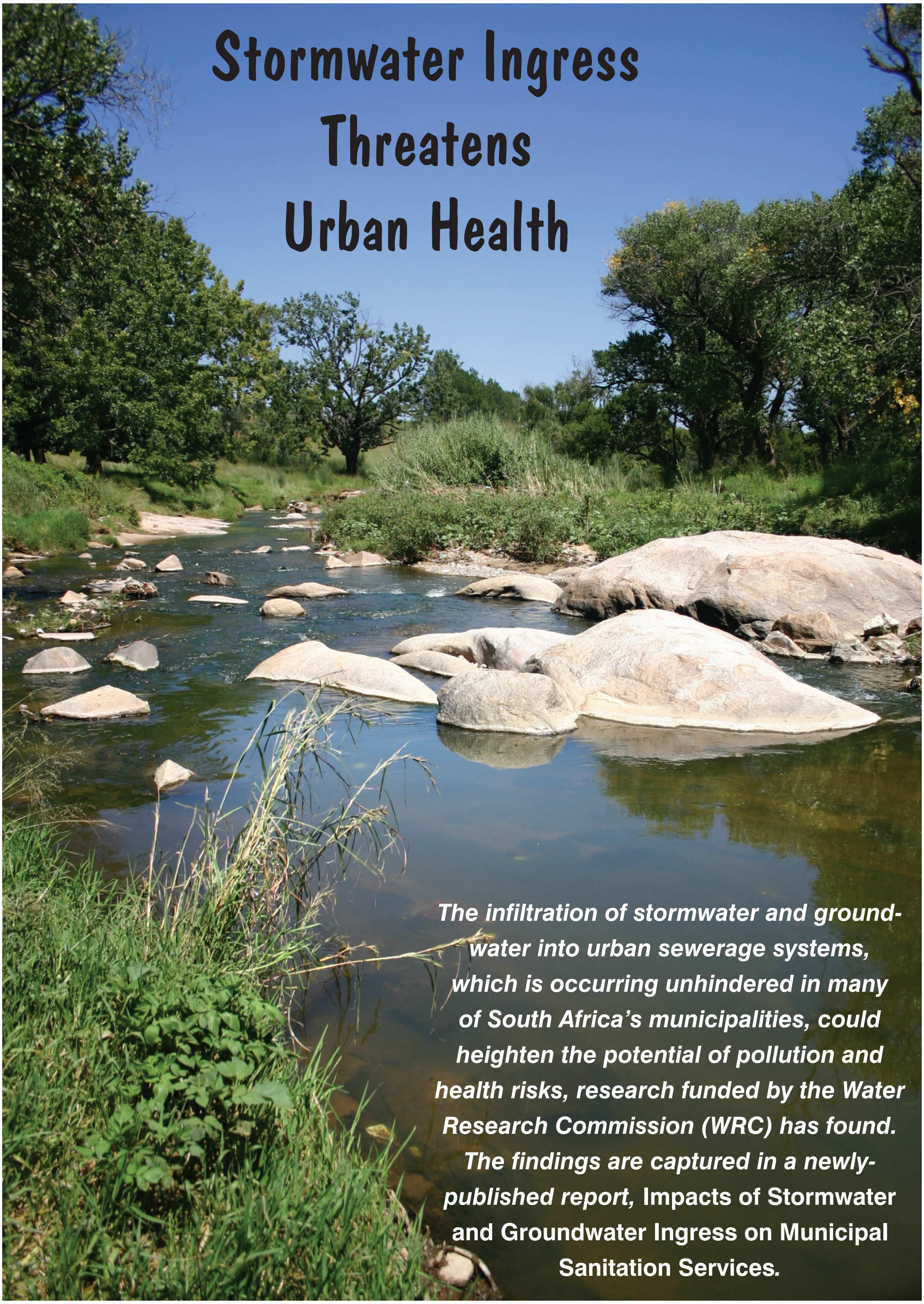


Stormwater Ingress Threatens Urban Health

The infiltration of stormwater and groundwater into urban sewerage systems, which is occurring unhindered in many of South Africa's municipalities, could heighten the potential of pollution and health risks, research funded by the Water Research Commission (WRC) has found. The findings are captured in a newly-published report, **Impacts of Stormwater and Groundwater Ingress on Municipal Sanitation Services*.***

Infiltration of stormwater and groundwater (known as extraneous flow) into sewerage systems is not a new phenomenon. In fact, it is a problem for municipalities worldwide. Systems are usually designed to handle some of this ingress (a norm of 15% of the dry weather flow allowance for extraneous flows is the generally acceptable standard). However, excessive flows can have detrimental effects on a sewerage system.

Research, undertaken by the Water Systems Research Group of the University of the Witwatersrand and captured in the new WRC report, has found that extraneous flow can reduce the originally designed capacity of a sewage collection system and negatively affect operation of the entire waterborne sanitation system, including the wastewater treatment component. This increases the potential of higher pollution loads leaving the wastewater treatment plant and disposing partially treated sewage into rivers, increasing the risk for waterborne diseases such as cholera.

The East Rand Water Services Company (ERWAT) indicates that the effect of extraneous flow on treatment processes can be rather dramatic as the final effluent produces will not comply with required effluent standards. Their experience shows that where stormwater ingress and groundwater infiltration are a serious problem, seasonally the built-in capacity of the wastewater treatment plant can be exceeded by up to twice for a limited time.

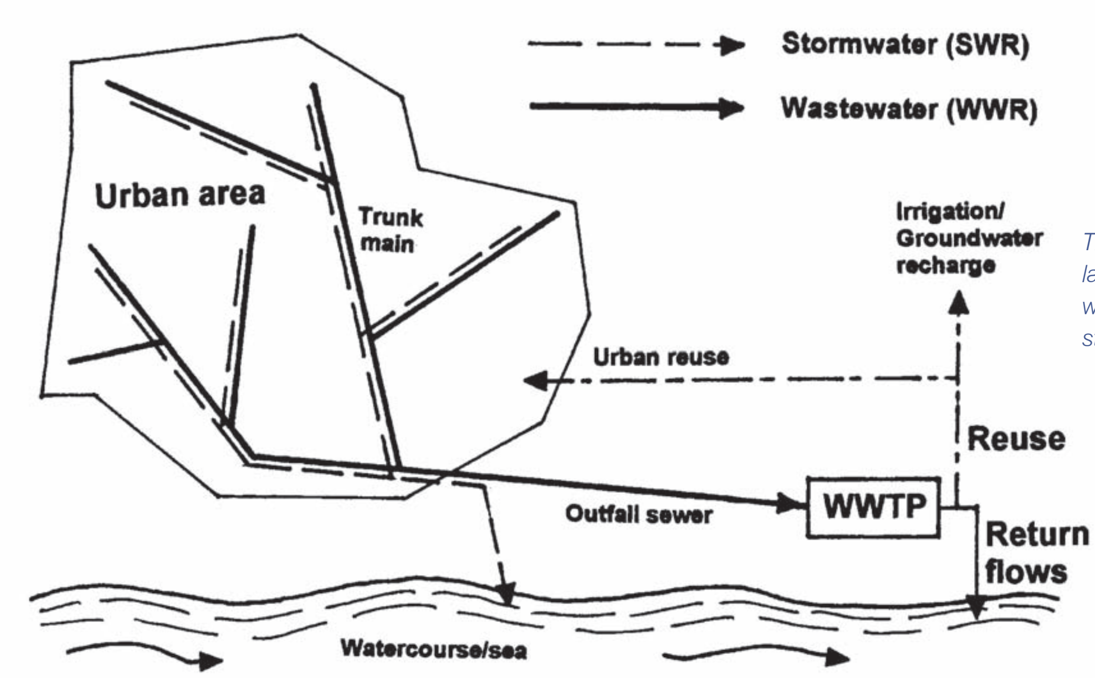
Investigations into municipalities nationwide found that most water services authorities (WSAs) and water services providers (WSPs) were not really aware of the infiltration problems and remedial or rehabilitation techniques. The problem is compounded by a general lack of adequate maintenance. Most municipal sewerage systems in South Africa are 30 to 50 years old, and the ageing process is taking its toll.

If allowed to continue unabated, stormwater ingress can lead to serious health problems in urban areas.

However, most municipalities are undertaking reactive maintenance only, where problems are dealt with on a corrective basis as they arise. Consequently, municipal wastewater system maintenance budgets are commonly low, and are based on the previous year's financial expenditure on clogging and collapse. An alarming find by the research team is that the typical sewer blockage rate in South African sewerage systems is 3,3 blockages per kilometre of sewer pipe a year. This is about ten times the international average.

COMMON CAUSES

The most common causes of stormwater inflows and groundwater infiltration were found to be inadequate design of certain system components; illegal house down-pipe (gutter) connections to municipal sewers; open gullies serving mainly as sullage disposal (this is typical in most formal and informal townships); unsealed manholes due to theft on manhole covers; faulty pipe joints due to improper construction or deterioration; roots penetrating joints; unwise man-made stormwater



The hypothetical layout of a separate wastewater from stormwater system

channelisation (e.g. road crossings and culverts); and unattended overgrown vegetation in natural channels as well as a high groundwater table.

Other factors that can contribute to infiltration to sewers are undulating topography that may lead to easy flooding; re-considered flood lines; swimming pools if additional stormwater or backwash water is linked directly to the sewers; ground movement due to removed mine dumps which destroy the continuity of sewers; and thunderstorms of short duration and higher intensities in various locations.

Disturbingly, investigations found that both stormwater inflow and groundwater infiltration are continuing to increase in South African municipal sewerage systems due to reactive maintenance instead of planned preventative maintenance and planned rehabilitation programmes.

"Stoppages and clogging of sewers in South Africa per unit length of sewer are about ten times higher than the international average."

The illegal connection of gutter down pipes to sewer gullies and the paving of yards, especially in sectional title properties, are some of the leading causes of stormwater ingress.

The WRC report proposes a number of approaches and methods on how to eliminate or mitigate the problems associated with extraneous flow. This includes the proper planning, design, construction, operation and rehabilitation of municipal sewerage systems.

EXCESSIVE EXTRANEOUS FLOWS

The urban area of Boksburg, which falls under the Ekurhuleni Metropolitan Municipality, was assessed as part of the research project. Next to residential and recreational grounds, it abuts an industrial area, and sewers are built through waterlogged ground. It was found that stormwater inflows amounted to up to 40% of sewer capacity and groundwater infiltration amounted to 15% of capacity.

Stormwater and surface inflows account for dramatic peak flows (up to three times the average dry weather flow). The source of the inflows can be attributed mainly to household stormwater being directed into the system through gullies and, to a lesser extent, due to missing or damaged manholes covers.

Extraneous flow can reduce the originally designed capacity of a sewage collection system.

REDUCING EXPENDITURE

A reduction in these extraneous flows will not only save on sewage treatment costs, but may defer capital expenditure for the upsizing of collection sewerage pipelines and wastewater treatment plants. One water and sanitation services provider which has realised this Johannesburg Water (JW). "By reducing the inflow of stormwater and infiltration of groundwater into the sewer reticulation systems as much as possible, it is not necessary to upgrade the sewer reticulation," explains JW networks manager Andries Lotz. "The result will be no capital expenditure and hence a saving in future operating budgets, which will mean a more acceptable tariff to the customer."

Lotz tells *The Water Wheel* that in the company's service area most stormwater ingress is the result of the illegal connection of domestic stormwater drainage systems to the sewerage system. For example, the connection of gutter down pipes to sewer gullies. The paving of yards is also a factor, especially in sectional title properties. Paving increases the quantity of water to be drained and therefore the height of the flowing water sheet. To get rid of this water, some individuals construct private manholes later which drain into the sewers or directly into the sewerage system.

To prevent this; the company has dispatched a number of meter and gully inspectors to inspect private properties. Where stormwater is illegally allowed to infiltrate the sewerage system, property owners are given notice to rectify this. If after a certain period of time the problem is still not rectified these transgressors can be taken to Johannesburg's municipal court where they can be fined if found guilty of contravening the metropolitan municipality's bylaws.

In addition, JW has a significant operation and maintenance budget to ensure its system functions optimally. A preventative sewer cleaning programme, which includes hydro-jetting vacuum tankers, is in place. "By using our management system, one can prioritise the most problematic areas to be cleaned. At present, 10% to 15% of the city's sewers are cleaned annually," notes Lotz. In addition, air tests are conducted on all new sewer reticulation systems to ensure that the system is water tight to prevent infiltration.

While inspectors' duties are made difficult by the sheer volume of erven as well as the difficulty of gaining entrance to some of these properties due to the high security, Lotz says the service provider is making progress.