

IRRIGATION

Curbing major water losses from farm irrigation schemes

A Water Research Commission (WRC) report is paving the way for a new 'Irri-Drop' monitoring scheme to reduce water leaks and losses from large irrigation schemes. Tony Carnie reports.

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Farming consumes the lion's share of South Africa's increasingly scarce water resources, making it imperative that every drop is used more carefully. Government research studies suggest that irrigated agriculture consumes a whopping 62% of national water demand every year – yet farming is also the least water efficient sector, with reported wastage of up to 45% in some irrigation schemes.

Adding to these challenges, studies point to a national water deficit of 17% by the end of this decade at a time when government is also striving to increase irrigated land by more than 50%. These are some of the reasons why the Department of Water and Sanitation requested the WRC to help develop a new framework for reporting water use efficiency in agriculture.

This framework, dubbed the Irri-Drop Report, aims to generate more information on the extent of agricultural water losses at irrigation schemes across the country. In a new report published by the WRC, local water and agriculture experts note that the framework borrows cues from existing schemes such as the Green-Drop, Blue-Drop and, more recently, the No-Drop reports, for rating water use efficiencies in wastewater and municipal water management.

The proposed Irri-Drop framework aims to provide a tool for assessing irrigation schemes in terms of water conveyance efficiency and the readiness of this sector to deal with water losses in a transparent manner. The project, titled *The state of irrigation water losses and measures to improve water use*

efficiency on selected irrigation schemes (WRC report no. 2970/1/23), was based on studies and data analysis from the Vaalharts and Loskop irrigation schemes (the two biggest irrigation schemes in South Africa).

It was compiled by researchers from the Agricultural Research Council; the University of Venda; the Department of Agriculture, Land Reform and Rural Development and the Gauteng-based software solutions company NB Systems.

The Vaalharts scheme, on the boundary of North West and Northern Cape provinces, is made up of a 1 176 km network of canals and storm drains covering an area of more than 29 000 hectares. The first canals date back to 1934, with most water fed to crops using centre-pivot irrigation systems. Some traditional methods, such as overhead sprinklers and flooding, are still in use, but on a very limited scale and are being replaced by micro-sprayer and drip systems. Vaalharts farmers produce a wide variety of crops including lucerne, groundnuts, pecan nuts, potatoes, cotton, olives, citrus, apricots, grapes, peaches, watermelons, grains, and vegetables.

Loskop, the second biggest public irrigation scheme, is fed by Loskop Dam at the boundary of Limpopo and Mpumalanga provinces. The reservoir irrigates an area of nearly 19 000 hectares via a 495-km long network of concrete-lined canals.

Dr Macdex Mutema, a senior researcher at the Agricultural Research Council and lead author of the study, notes that upgrading irrigation infrastructure can be very costly. Therefore, it is important to redirect funding to projects that can yield the best water saving benefits (such as information management systems which have shown potential to improve sustainability and to modernise irrigation systems).

Mutema says one of the key findings of the study was that global water losses at Vaalharts were around 20% per year (19.4% and 18.7% for the 2019/20 and 2020/21 water years, respectively) whereas water losses from the Loskop scheme were around 25% (25.2% and 25.1% for the same water years).

The authors note that the lower percentage losses at Vaalharts still constitute much greater volumetric losses (81.9 and 67.6 Mm³ for 2019/20 and 2020/21, respectively) compared to Loskop (34.7 and 35.6 Mm³ for 2019/20 and 2020/21, respectively) because it is a much bigger irrigation scheme with greater annual water consumption.

But Mutema emphasises that these losses apply only to the irrigation canal distribution scheme – not to losses on farms or farm reservoirs served by the schemes. He notes that there is often an assumption that most of the losses occur within irrigation schemes, whereas losses at farm level are also significant – potentially exceeding 20%.

“A very important recommendation is to extend the Irri-Drop Report concept to at least cover on-farm water delivery networks in addition to the current focus on water conveyance networks between the main reservoirs and farm gates,” the report states.

“There is an urgent need to address this information gap for

better accounting of water deliveries to farmers. Nevertheless, establishment of more gauging stations at strategic positions of the canal networks is still important because the best and less financially stressing way to minimise water losses from canal networks is to identify problem areas and take remedial actions, which is only possible with a dense network of gauging stations.”

Overall, the report concludes that it is still feasible to develop an incentive-based programme (similar to the No Drop Report) for use by the Department of Water and Sanitation as a tool to encourage higher water conveyance efficiency in irrigation schemes. It notes that both Vaalharts and Loskop are equipped with flumes (engineered concrete structures to measure the flow of water in open channels). However, many flumes were now largely obsolete or did not have gauging staves and there was a need to replace them with new, less-labour intensive technology to reduce drudgery and associated human errors.

A better alternative was to use electronic data loggers, which are more accurate and have the further advantage of allowing data to be downloaded from a remote location. But this technology was currently too expensive to install at every offtake point on the canal networks including the farm gates.

One of the most urgent recommendations was therefore to identify appropriate gauging stations on the main canal, secondary, tertiary and community canals and to equip these gauging stations with accurate measurement devices. The researchers emphasise that like any other computer-based programmes, the quality of the reports published on online platforms will depend on the quality of input data.

“Therefore, it is important to have a good working data collection system and competent personnel to handle the data collected.” Another key finding from the project was confirmation that evaporation water loss from canals is negligible in comparison with the other losses.

“The last very important finding is that good technical design of canals needs to be supported by equally good management and maintenance plans for better water conveyance performance.”

Several measures for improving the efficiency of canals have been put forward, including improvements in operations and maintenance of the infrastructure. This should include proper maintenance plans and sealing the gaps between the concrete slabs which make up the canal walls and beds in order to reduce leakage.

Mutema notes that most of the big irrigation schemes have shutdowns twice a year for maintenance and sediment clearance. During this period, some farmers have to depend on their own reservoirs as a temporary water supply. While maintenance shutdowns could last for one to two weeks, longer shutdowns could create problems for farmers, especially in areas furthest downstream.

However, if joint cracks and holes were not repaired timeously, the damage became worse over time and magnified the volume of water losses. Mutema also saw evidence of damage to concrete canal structures by rodents burrowing through



Maintenance workers repair a damaged section of canal at the Loskop irrigation scheme.

weak or cracked sections. “We are talking of holes 40 – 50 mm in diameter dug by rodents, as well as cracks that had not been repaired for four years.

“We also saw scenarios where there is a significant increase of households moving closer to the canals to access water for livestock or domestic use.”

There was further evidence of farmers whose crops appeared to be thriving, even in areas where nearby canals were dry. So, the suspicion was that these farmers were accessing borehole water (or surface water from drainage canals). However, the volumes of water lost in this way had not been quantified.

Mutema and his colleagues note that maintenance and repair work of water infrastructure in irrigations schemes is sometimes hampered by a lack of clarity over ownership and responsibility between water users and irrigation authorities. In addition, some farmers lacked the skills and resources to maintain and repair canals. Hence, they depended on the authorities.

In addition to a lack of skills and resources, farmers often lacked the collective ability or willingness to perform the tasks needed, partly because maintenance requires closing the canals for

repairs, which interrupts production and subsequently farmers’ livelihoods.

“This is one reason why farmers are generally reluctant to support rehabilitation works in the absence of subsidies,” the report says.

Prof Sylvester Mpandeli, the WRC Executive Manager for Water Utilisation in Agriculture says: “The bottom line is that we need to reduce water consumption in farming due to human population growth and climate change. So, it’s very important that our farmers use less water to provide more food. We should also be embracing the Fourth Industrial Revolution to monitor water use.”

On the crucial issue of who should be held responsible for canal maintenance, Mpandeli says: “Our farmers need to understand that government does not have money to maintain these canals.

“Many irrigation farmers are also generating foreign exchange from exports, and they need to get together to decide how they are going to maintain the canals rather than waiting for the government to assist them. We still have a long way to go in learning from other countries in this respect,” says Mpandeli,

Image supplied



A section of broken wall on one of the canals at the Loskop irrigation scheme. Enormous volumes of water can go to waste if irrigation canals are not maintained properly.

who is also Vice President of the International Commission on Irrigation and Drainage (ICID).

Mutema notes that while large irrigation systems such as Loskop and Vaal-Hartz have well established management and maintenance schemes, the percentage water losses are likely to be higher in smaller irrigation schemes (possibly exceeding 40%).

Mpandeli adds that there are plans by the WRC to launch follow-up projects next year to fill in some of the information gaps and to quantify irrigation water losses more accurately at a provincial and catchment level.



Loskop Dam in Mpumalanga irrigates an area of nearly 19 000 hectares via a 495-km long network of concrete-lined canals.

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One of the canals on the Vaalharts irrigation scheme, the biggest government irrigation scheme in the country.