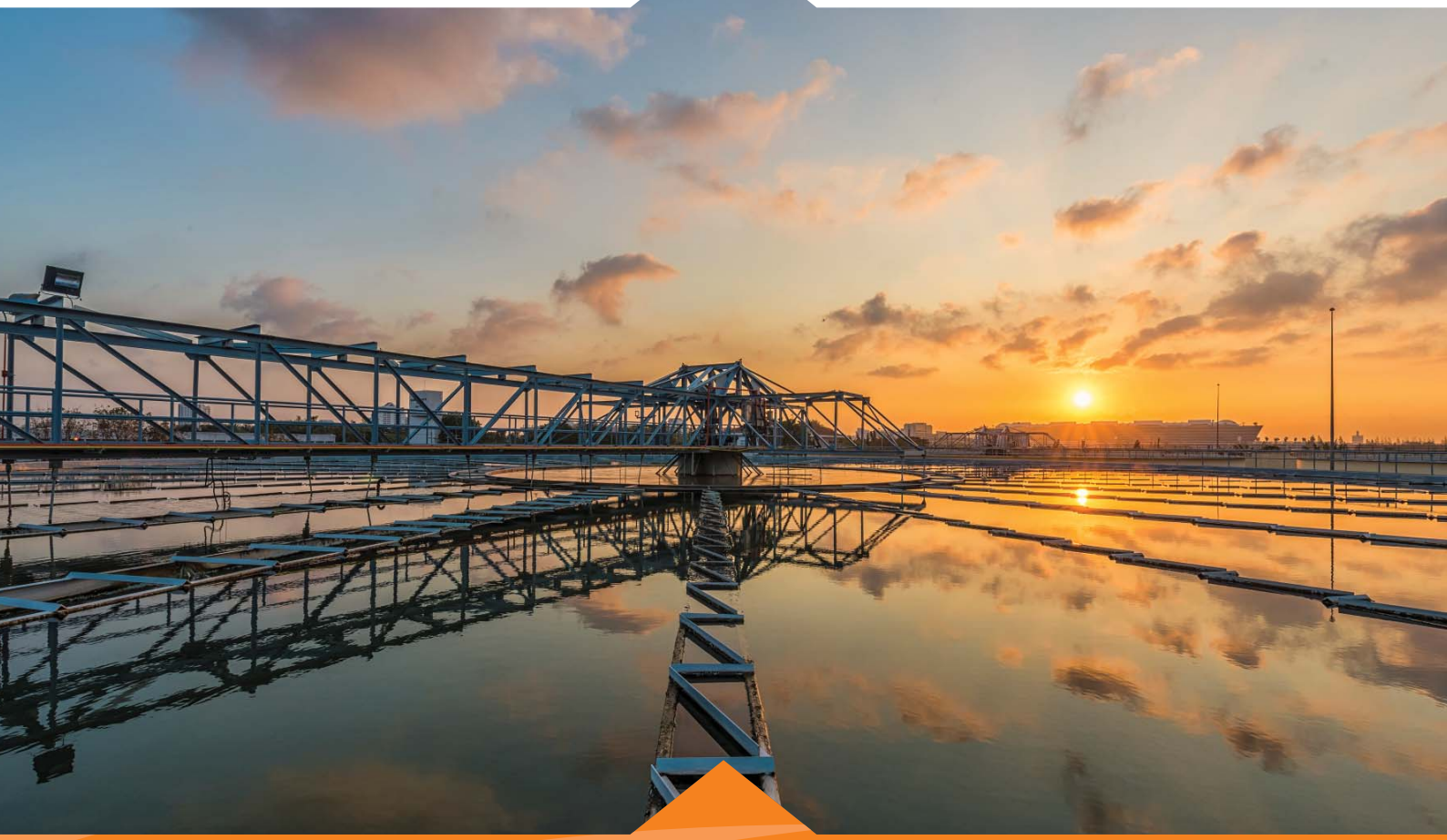
FIELDNOTE

Identification and abatement of risk ensures 100-year-old wastewater scores positive Green Drop status



WIN-SA
WATER INFORMATION NETWORK
- SOUTH AFRICA -

WATER RESEARCH COMMISSION

September 2018

Wastewater treatment services are one of the core business responsibilities of a municipality. Legislation ensures access to water services, affordably and effectively, to all consumers in an economic and sustainable manner. However, the poor state of operations and maintenance of infrastructure in South Africa, not only in water services but across all sectors, is widely bemoaned. In this Fieldnote we profile the grand old Daspoort Wastewater Treatment Works in Pretoria, which despite being more than a century old with budget constraints, is still operating at well within acceptable Green Drop parameters.

Kerneels Esterhuyse, Acting Deputy Director: Technical Support and Compliance Management , City of Tshwane

Pretoria's Daspoort Wastewater Treatment Works (WWTW) might have infrastructure built over a century ago, but this has not prevented it from still providing a crucial service to the city. Constructed between 1913 and 1920 on the southern banks of the Apies River in Pretoria to serve the town's 40 000 residents at the time, the plant is situated adjacent to the central business district, and today is one of 15 City of Tshwane sewage treatment plants in operation.

According to the 2014 Green Drop report released by the Department of Water and Sanitation (DWS), the Daspoort plant remains the most compliant of all the city's plants and one of the better performing in Gauteng Province as well.

The Daspoort WWTW employs technologies such as a BNR activated sludge, and biological filters for liquid processing. On the sludge side, it uses DAF thickening, anaerobic digestion and solar drying beds. But many plants across the country use these technologies, so what sets Daspoort WWTW apart from others?

The commitment of its well-trained staff is definitely one of the success factors.

As the City of Tshwane's Kerneels Esterhuyse puts it, "Daspoort WWTW is managed by a dedicated and stable staff component of qualified professionals who are devoted to detail and immediate repairs, to continuously optimise the operation of the plant ensuring it produces good quality effluent. Equipment and machinery is properly maintained and repaired. The Daspoort team works independently, as one of many professional teams in the Waste Water Treatment Section of the City of Tshwane. Good work-output is incentivised."

"Poor process control and supervisory skills can translate into poor effluent compliance, so at the Daspoort WWTW we prioritise process control system maintenance and training of technical staff to ensure identification and abatement of risk." Kerneels Esterhuyse, Acting Deputy Director: Technical Support and Compliance Management, City of Tshwane

Effective wastewater management is required to safeguard South Africa's water resources and their associated economic, social and environmental benefits. The Green Drop assessments demonstrate the performance over time of the country's wastewater treatment systems. The DWS developed the incentive-based Green Drop (GD) Certification Programme in 2008 to monitor and improve the performance of wastewater treatment works and water services in South Africa.

Since then, this uniquely South African approach has managed to improve municipal wastewater management and keep the public and stakeholders informed and updated with credible and current information.

The latest, 2014 Green Drop Progress report is based on a self-assessment by the municipalities and confirmed by the DWS to ensure credibility and verified information is reported to the public. The DWS team that served as moderators for the information provided by the Water Services Institutions is made up of a trained group who not only assesses the performance, but they also ensure that regulatory advice is given to municipal wastewater management on required improvements.

The main objective of this regulation approach is to identify, measure and develop the core competencies required for the sector that, if strengthened, will gradually and sustainably improve the level of wastewater management in South Africa.

One of the key performance areas within the national Green Drop Certification programme is the presence and implementation of risk abatement management by a Water Services Institution. The Department has commenced with risk-based regulation in 2008, thereby establishing a baseline risk profile for each municipal plant in South Africa. The table below demonstrates the performance of the Daspoort plant.

Daspoort WWTW Green Drop performance: 2013-2014		
Risk trend per plant as %CRR/CRR max		
Technology (Liquid)		Activated sludge and BNR and Biological filters
Technology (Sludge)		DAF thickening, Anaerobic digestion and Solar drying beds
Key Risk Areas		
A: ADWF Design Capacity (Ml/d)		51
B: Operational flow (% of Design Capacity)		82%
C:	Annual Average Effluent Quality Compliance (2012-2013)	83.5%
	1) Microbiological Compliance (%)	79.9%
	2) Physical Compliance (%)	97.9%
	3) Chemical Compliance (%)	74.2%
D: Technical skills (Reg 813)		Yes
2014 Wastewater Risk Rating (%CRR/CRRmax)		48.1%
2013 Wastewater Risk Rating (%CRR/CRRmax)		50.0%

The Daspoort WWTW uses technological innovation to improve efficiency and effectiveness in the plant, strengthen performance measurement monitoring and measurement, and address shortcomings.

The latest Green Drop Assessment uses the Progress Assessment Tool (PAT) which is a desktop assessment without generating a Green Drop, and only measuring the risk ratio. The Daspoort plant continues to perform well within acceptable parameters.

The case for keeping old plants onstream

If the performance of the Daspoort WWTW is anything to go by, then it would appear that there is a case for keeping old plants onstream. The Daspoort plant was built over a century ago to the design of Town Engineer F Walton Jameson (nicknamed 'Jacaranda Jim' for his introduction of the trees to Pretoria).

Wastewater from the central Pretoria area is collected in a main outfall sewer that runs alongside the Apies River past the Daspoort WWTW to the Rooiwal WWTW. The first works at Daspoort comprised screens, grit removal channels, primary sedimentation tanks (Dortmund tanks), 16 biological filtration units, and separate sludge digestion

in rectangular tanks. Sixteen biological filters were constructed to form four units of four biological filters each. The design capacity was two mega-gallons per day (equivalent to 9 Mℓ/day). The performance of these biological filters today, after 100 years of service, is a fitting tribute to a great South African pioneer in the science of wastewater treatment. Jameson was also responsible for the appointment in 1920 of the first chemist as manager of a watercare works in South Africa, namely Mr M Lundie.

The original biological filtration units are still in use. Image credit: Lani van Vuuren

In 1945, following the Second World War, two more biological filters were constructed with a total capacity of two gallons per day (9 Mℓ/day), and the last biological filter was built in 1947 to bring the total designed treatment capacity to six mega gallons per day (27,5 Mℓ/day). With this last biological filter, two 27 m diameter Dorr digesters were also constructed, bringing the total digestion capacity up to 12 000 m3. Daspoort supplied cooling water to the Pretoria West power station from 1952. For supplying the cooling water, extra humus tanks, a balancing tank, collecting tank, five rapid gravity sand filters for 12 Mℓ/day and a pump station were added at a cost of about R240 000.

For the next 20 years, no further extensions were made at Daspoort except to the sand filters and the balancing dams, but the Rooiwal plant was built to treat the constantly increasing wastewater flow from the city. Between 1973 and 1976 the biological treatment capacity at the Daspoort WWTW was increased from 27 Mℓ/day to 64 Mℓ/day. The activated sludge reactor which was then constructed, included screening, grit removal tanks, primary settling tanks (Dortmund), activated sludge aeration by 27 mechanical surface aerators in nine aeration tanks, and secondary settlement in six flat-bottom tanks with mechanical scraping and hydraulic suction lift of the activated sludge. This wastewater treatment works was then designed to produce an effluent conforming to the General Standard without tertiary treatment.

In the 1970s the Water Research Commission ran the Stander Water Reclamation Plant at Daspoort. The plant, which had a capacity of 4,5 Mℓ/day, was used for research and development and served as a prototype for large-scale water reclamation processes. Following the publication of the Special Standard for Phosphate in 1984, one of the three activated sludge reactors was retrofitted in 1986. After successful retrofitting, it took nine years to retrofit the other two activated sludge reactors. This work was finally completed in 1995. Since that time Daspoort has mostly complied with the phosphate standard. In 1997, the first ultraviolet (UV) light disinfection of wastewater plant in South Africa was commissioned successfully at Daspoort.

The plant has a current operational capacity of 55 Mℓ/day. In 2009, Daspoort became one of the few wastewater treatment plants nationally to obtain a Green Drop. Unfortunately, it lost its status in the latest round of assessment – this was mainly due a minor drop in the effluent quality for the assessed period due to vandalism of infrastructure, i.e. cable theft. Still, after more than a century of operation, the works continues to provide a valuable service to one of the country's largest cities.

Water, a constitutional mandate

The National Water Act of 1998 states that as the public trustee of the nation's water resources the National Government, acting through the Minister, must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons and in accordance with its constitutional mandate. Wastewater treatment works remain just one of the many water users of these resources. To control the water uses within the legal requirements of the Act, the DWA must monitor WWTWs.

In order to undertake an inspection and give guidance on how to solve a problem it is important that the person undertaking the inspection fully understands the complex nature of various unit processes involved in the treatment of wastewater. There are currently several handbooks with relevant technical information for the various processes.

References:

- An investigation into the barriers to implementation of effective wastewater charges by municipalities in South Africa, WRC Project Number: 2210 (KSA 3)
- Efficient resolution of operational problems in water networks by logging and analysing pressures and flows, e.g. Tlokwe Local Municipality, WRC Project Number: 2307 (KSA 3)
- Piloting the algae-based wastewater treatment (phycoemediation) to achieve a significant improvement of the quality of effluent discharge at two municipal wastewater treatment works, WRC Project Number: 7050 (KSA 14)
- Development of a Decision Support Tool for Appropriate Wastewater Treatment Technology Selection, WRC Project Number: 7023 (KSA 17: Empowerment Fund)

For more information on the Daspoort Wastewater Treatment Plant contact Kerneels Esterhuyse , at Acting Deputy Director: Technical Support and Compliance Management , Utility Services Department, Daspoort WWTW , City of Thswane at kerneelse@telkomsa.net or visit www.wrc.org.za for downloading the reports .

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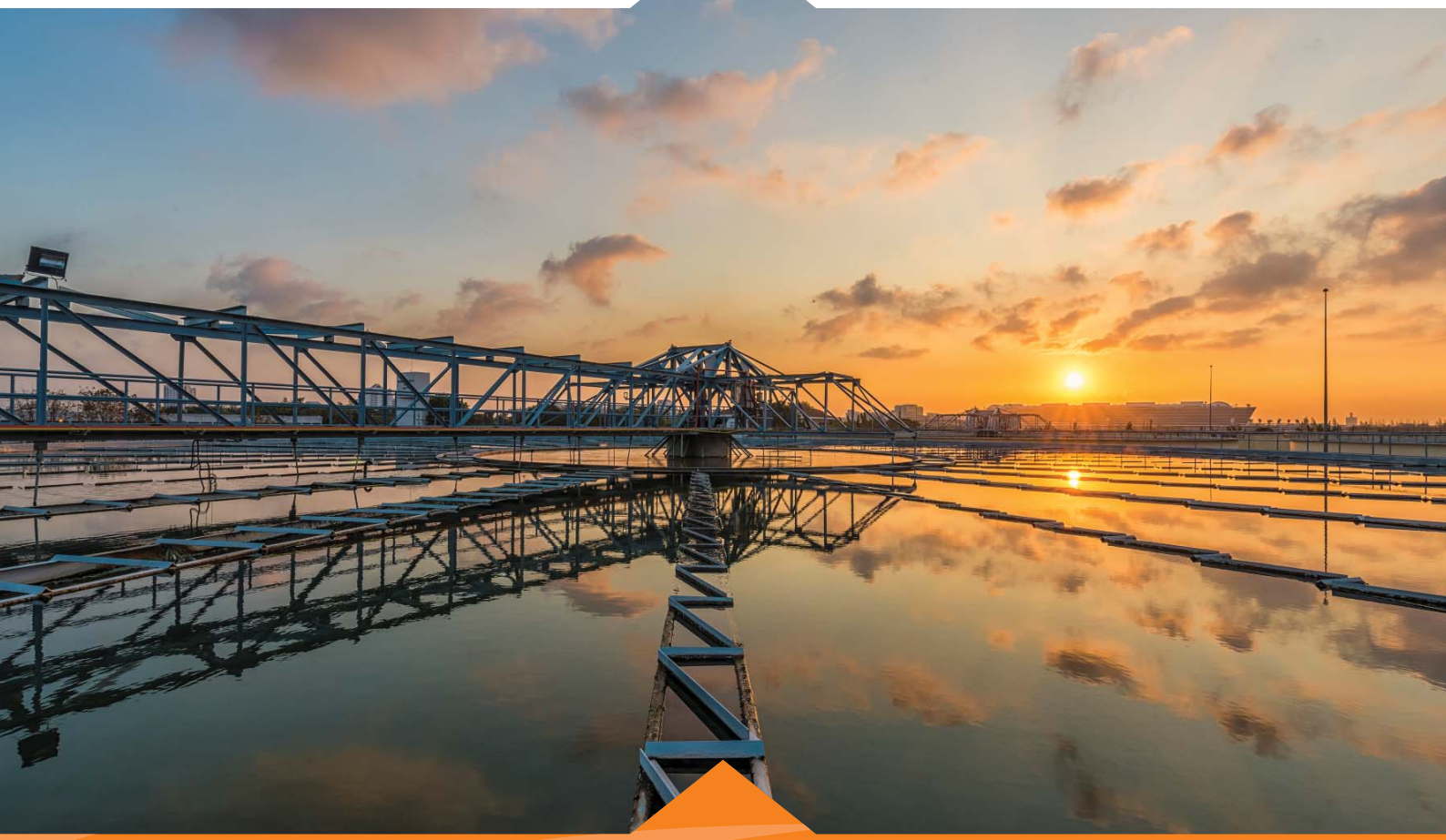

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