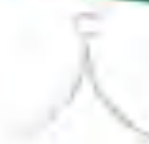


GREEN DROP

Department of Public Works

2022



"Water to All. Sanitation to All. Dignity to All."



water & sanitation

Department
Water and Sanitation
REPUBLIC OF SOUTH AFRICA



green drop

CERTIFICATION

Water and Sanitation
REGULATION



It gives me pleasure to present this 2022 Green Drop report. The President announced the relaunch of the Green Drop Certification programme in his State of the Nation Address, and we are pleased to have delivered on this commitment. We recognised that as a flagship project, this incentive-based regulation programme has the power to mobilise the wastewater sector on a path to improvement.

Wastewater management and sanitation are paramount to the dignity of our people and integrity of the environment and it is therefore important that we strive for excellence in these fields. Even though the Green Drop programme has been at the centre of much of the improvement in the sector over the years and has brought about change and reignited the passion amongst our wastewater specialists, the results of this report serves as a scientifically calculated indicator that there is still a mammoth task ahead of us.

It remains unacceptable that sewage spillages and failing wastewater treatment works are detrimentally impacting our environment as well as the livelihood and health of many of our communities on a daily basis in the year 2022. It is of great concern that there are so many systems with scores below 31%, indicating a dismal state of wastewater management, posing a risk to both environment and public health. I am therefore making the call to political, public, and private leadership to declare their commitment to use this report as the turning point towards sustainable improvement, because everyone can make a difference within their sphere of influence. I need to make it clear that action will be taken against those municipalities that flagrantly put the lives of our people and environment at risk. As Minister of Water and Sanitation, I am engaging the Minister of Cooperative Governance to ensure that as National Government we take drastic intervention measures towards the improvement of water services.

We will use this report as the baseline for the Water Services Improvement Programme (10-point plan) from where we will measure the sustainable turn-around which we aspire to.

However, we are proud of those municipalities who have displayed their commitment towards effective wastewater management, even in the absence of the Green Drop programme over the past few years. The Green Drop scores achieved prove that excellence in the field of wastewater management is a realistic possibility and will remain the performance target for all to plan towards.

A special congratulations to the leadership, management and staff of those systems that attained the prestigious Green Drop status.

We move forward knowing that we do not accept 'being good' as the norm for the South African wastewater industry instead, we endeavour towards excellence.

Minister for Water and Sanitation: Mr Senzo Mchunu



It is a privilege to be part of the release of this Green Drop 2022 report, and I am encouraged by the few pockets of excellence that exist in the wastewater space in our country. It speaks volumes of those women and men who proudly conducted the important work they do in the background over the audit period. We will encourage Municipal Management and Leadership to support them to continue on their path to higher levels of excellence.

We will also call upon on all municipal leadership to note the results of the wastewater systems in their areas of responsibility; to take keen interest in ensuring improvement.

The reality of sewer spillages demands decisive leadership from all of us in order to protect our communities and safeguard our environment. It is going to take a team effort to ensure that future Green Drop reports will present all round improvement in the management of wastewater services.

Deputy Minister for Water and Sanitation: Ms Dikeledi Magadzi



This report should trigger a passion and commitment in all of us to transform our thinking of wastewater treatment systems. These plants demands the merging of scientific and engineering skills to ensure that we have the capability to treat used water to acceptable water quality standards, which allows the reuse of our precious resource.

However, the results of this report indicate that too many of our systems are not being managed according to expectations, resulting into a detrimental impact on our water resources. We cannot allow this to continue. The Green Drop Standards serve as a clear guide towards excellent wastewater management, and we would encourage all responsible to invest in upgrading your operational philosophies with clear objectives, to prevent sewer spillages, to treat effluent to acceptable standards, and to ensure effective sludge management.

I salute those who displayed commendable discipline and commitment towards protecting our environment by managing their wastewater systems according to the standards set by the Green

Drop Certification Programme.

Deputy Minister for Water and Sanitation: Mr David Mahlobo



The Green and Blue Drop Programmes lie at the heart of our vision to provide “safe water for all, forever” and our mission to “effectively manage the nation’s water resources to ensure equitable and sustainable socio-economic development and universal access to water”. These programmes not only support achievement of our strategic objectives but also align with our effort towards the United Nation’s Sustainable Development Goals for clean water and sanitation, and climate action. It is therefore reassuring that the number of WSIs achieving Green Drop Certification has not materially fallen off, despite the lag since the 2013 GD process.

This year’s results may not have shown the progressive improvements that we saw in previous cycles, but I am confident that we will get back on the right trajectory. This year’s assessment has provided us with a baseline and the platform to launch the turnaround. As in previous years, the programme was widely embraced and the general euphoria around the process tends to spark improvements in subsequent cycles. Despite the process being compulsory, participation was driven more from

deeper institutional commitment to progress and achieve excellence using the audit process as a barometer for change.

We have received international acclaim in the past and it will be important to re-establish the programme as the international benchmark for incentive-based regulation. We continued to innovate over the years through strengthening the scorecard and other regulatory tools. This year, we were able to introduce the “Very Rough Order of Measurement” (VROOM) model as part of the Green Drop Technical Site Assessments. At a high level, the VROOM provides insights on the state of the key elements of the wastewater treatment infrastructure and provides an order of magnitude estimate of cost to return the infrastructure to a functional condition. It is this kind of valuable insight gained from the GD process that can inform a coordinated response by DWS and other sector players.

As a department, we have continued to build internal regulatory capacity. We trained 96 of lead and assistant inspectors who were deployed as part of the 2021 GD Audits and hope to have influenced the 995 WWTWs (850 WSAs, 115 DPW & 30 privates) through our consultative audit process. We are committed to making the process as seamless and painless as possible for all Water Services Institutions and will incorporate the lessons learnt into the process for the subsequent cycles. We would like to see the GD process embedded and outcomes informing the planning, budgeting and professionalisation of the wastewater sector.

I would also like to express my appreciation to all the WSIs leaders and their officials who participated in the process. It is only through our combined efforts that we can improve the state of wastewater management in the country.

Director-General for Water and Sanitation: Dr Sean Douglas Phillips



The history of water will be measured not by its quantity but its quality...
Institute for Water Quality Management, 1970's.



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1. INTRODUCTION

The history of water will be measured not by its quantity but its quality...

*Lucas van Vuuren
Institute for Water Quality Management, 1970's*



Purpose and Intent of Green Drop Certification

Since its inception in 2008, the Green Drop regulation programme sought to identify and develop the core competencies that, if strengthened, would gradually and sustainably improve the standard of wastewater management in South Africa. The intention was to align the minimum requirements and best practice as a new Green Drop standard to raise the bar for wastewater management. The programme is therefore not based on the results of a limited number of random samples but evaluates the entire wastewater management services over a one-year audit period.

The Green Drop process is recognised as an international best practice and has received both local and international accolade. It is based on a consultative audit process that seeks to empower those responsible for wastewater management to deliver according to the set standards. It is also a transparent process, with clearly defined criteria that is geared to protect consumers from potentially unsustainable and unsafe services, as well as protecting the country's water resources.

The Green Drop audit criteria are designed to complement the efforts of other government and stakeholder programmes. They provide essential information to inform planning by sectoral partners, with the shared objective of achieving functional wastewater systems in the short term and excellence in wastewater management in the longer term.

The Green Drop audit process is intended to inspire a path that brings about sustainable compliant wastewater services through competent people, disciplined thought, and collective action which can be measured and reported to South African citizens every year.

*Greatness is not a function of circumstance.
Greatness, it turns out, is largely a matter
of conscious choice, and discipline*

Jim Collins

*This report acknowledges those institutions that aim and plan for progress and greatness
...and rewards those that achieve it.*

Incentive-based Regulation in South Africa

(Green Drop Certification)

Incentive-based regulation has gained significant momentum and support in the South African Water Sector, since its inception on 11 September 2008 (Minister of Water Affairs, National Municipal Indaba, Johannesburg). The concept was initially defined by two programmes: *Blue Drop Certification* for Drinking Water Quality Management Regulation; and *Green Drop Certification* for Wastewater Quality Management Regulation. *No Drop Certification* was added in 2014 that focused on water conservation and demand management in the municipal sector.

The Green Drop Wastewater Services Audit measures and compares the results of the performance of Water Service Institutions, and subsequently rewards (or penalises) the institution based on evidence of excellence (or failures) when measured against the defined standards. Benchmarks are used to help WSIs to identify gaps between their standard and industry norms. The report is designed to give comparative analysis and diagnostics to assist WSIs to focus on specific areas for improvement. Awareness of this performance is intended to hold WSIs to account, with pressure from consumers, media, politicians, business, and NGOs.

Each Green Drop audit cycle is marked by incremental change in the audit criteria, guided by the status and priorities of wastewater sector. It is therefore important for WSIs to note that merely maintaining the previous cycle's Green Drop evidence and performance will not warrant the same Green Drop score.

Whilst the *Green Drop assessment* focuses on the entire value chain (sewer collector, pumping, treatment, discharge) of the wastewater business within the municipalities (or other WSIs), the *Cumulative Risk assessment* focuses on the wastewater treatment function specifically. The latter approach allows the Regulator to have a database of the risk status and indicators for each treatment system in South Africa. As a 'sister' programme to Green Drop audits, risk-based regulation allows a WSI to identify and prioritise the critical risk areas within its wastewater treatment process and to take corrective measures to mitigate these. Risk analysis is done annually via the full Green Drop audit process, as well as in the alternate years via the Green Drop Progress Assessment (PAT) assessment. The results are published in the biennial Green Drop Report, as well as the Green Drop Progress (PAT) Report every alternate year.

The Department of Water and Sanitation integrates risk analysis as part of the audit process with the aim of quantifying, prioritising, and managing the risks to ensure targeted regulation of high-risk municipalities. The Wastewater Risk Abatement Plan (W₂RAP) is the tool whereby risks are identified and corrected, following a similar process of the reputed Water Safety Plan (WSP). A W₂RAP guideline is available to assist users (Water Research Commission, WRC TT 489/11).


Green Drop Scores

The main outputs from the Green Drop 2021 audit cycle are:

- ◆ A Green Drop audit score for each wastewater system assessed, which is aggregated into an organisational (overall) score, expressed as a percentage (%)
- ◆ A Cumulative Risk Rating for each wastewater treatment works, expressed as a percentage (%)
- ◆ Technical Site Assessment (TSA) score for selected collector and treatment systems inspected, expressed as a percentage (%)
- ◆ A collective VROOM cost for all treatment systems within each WSI, expressed in Rand.

Each indicator and its reference elements, can be described as follows:

- ◆ **Green Drop Audit Score:** A Green Drop % is awarded to an individual wastewater system based on the results from the audit process which measures performance against 5 Key Performance Areas (KPA), plus a suite of bonuses and penalties. The individual audit scores aggregate as a single (weighted) institutional Green Drop audit score. The score is weighted against the design capacities of the individual treatment plants. This score serves as a Performance Indicator of the capacity, compliance, and good practice that the institution attains against the Green Drop Standards, which again have been derived from national and international standards. A wastewater system that achieves $\geq 90\%$ Green Drop score, is regarded as excellent. A system that achieved $< 31\%$ is regarded as a dysfunctional system which would require appropriate interventions. **[Note: The audit covers the sewer network and treatment systems. On-site sanitation is not part of the audit].**
- Institutions that achieve $\geq 90\%$, are Green Drop Certified in acknowledgement of excellence**


- ◆ **Green Drop Certified and Green Drop Contenders:** A wastewater system that achieves an overall $\geq 90\%$ Green Drop score and $\geq 90\%$ for microbiological and chemical effluent qualities, is regarded as excellent and is thereby "Green Drop Certified". A system that achieves an overall $\geq 90\%$ Green Drop score but did not meet the $\geq 90\%$ final effluent quality standards, is a "Green Drop Contender". In such case, the Green Drop score is adjusted to 89%.
 - ◆ **Green Drop PAT:** The Green Drop Progress Assessment Tool is an instrument whereby the Department confirms and updates functional information and completes a risk assessment for each registered treatment works. The tool assesses risk via a weighted formula: $CRR = (A \times B) + C + D$, whereby the four risk indicators are comprised of the treatment plant's design capacity, operational inflow, technical skills, and final effluent quality. The results are published in a biennial Green Drop Progress (PAT) Report in the alternate year to the full Green Drop Report and includes a historic comparison of the plants' risk movement since 2009 to the current PAT year.
 - ◆ **Cumulative Risk Rating:** Risk is calculated for each system using a formula: $CRR = (A \times B) + C + D$, where:
A = Hydraulic design capacity of the treatment plant in Ml/day
B = Operational flow as % of the installed design capacity
C = Number of non-compliant effluent quality parameters at point of discharge to receiving water body
D = Number of technical skills gaps (supervision, operation, maintenance) in terms of Reg. 2834 & Draft Reg. 813.

Each risk element carries a different weight in proportion to the severity of the risk element (Annexure A).

CRR% deviation is calculated to show the variance between the baseline CRR and the maximum CRR value that could potentially be reached if all 4 risk indicators are in a critical state. *Example 1:* a 95% CRR %deviation value means the plant has only 5% space remaining before the system will reach its maximum critical state (100%) – this is an undesirable state. *Example 2:* a 25% CRR %deviation value means the plant holds a low and manageable risk position and that the 4 risk indicators are individually and collectively mitigated – this is a desirable state.

◆ **Technical Site Inspection Score:** A physical inspection is done at 1 to 2 sites to confirm the findings of the desktop audit. These sites are chosen based on their size, technology, and audit findings to best represent the potential state of the remainder of the sewer networks and treatment works. The TSA percentage reflects the physical condition of the sewer collector network, pumping stations, treatment plant and point of discharge. The intention of the TSA is to verify the evidence presented and findings of the Green Drop audit by undertaking a physical inspection of the selected site/s. Such inspections consider the:

- Appearance of the plant terrain and buildings
- Condition of structures, equipment, and process units
- Health and safety defects
- Operational knowledge and monitoring
- Workplace satisfaction.

The scorecard (*right*) provides the scoring criteria used for each inspection point.

1	Best performance and fully functional
0.75	Fully functional, but with minor corrections to be made
0.5	Partially functional and average performance
0.25	Partial performance with major corrections to be made
0	Failure and poor performance
NA	In case of a process unit absent / not part of the plant design, assign NA = Not Applicable

◆ **VROOM costing:** The Very Rough Order of Measurement (VROOM) is an estimation of the funding required to restore existing infrastructure to its original design capacity and operations, by addressing civil, mechanical, and electrical defects. The cost is derived through an algorithm that uses the Green Drop Inspector’s impression of the condition of the hardware, coupled with the system-specific design capacity and Green Drop score to derive an aggregated score for all treatment works within the organisation. The algorithm uses the refurbishment cost estimate of 1 to 2 systems and extrapolates it according to the other input values to arrive at an institutional cost, i.e. VROOM estimation. **NOTE: It does not constitute a specification, schedule of quantities or a definite refurbishment figure, but rather an indicative amount to inform a budget and hardware requirements.**

Further terminologies that support the above concepts are as follows:

◆ **WSI:** A Water Services Institution is defined as “...an entity, utility, or authority that provides water services to consumers or to another water services institution, and thereby is subject to compliance with the water laws of South Africa. WSI also means a water services authority, a water services provider, a water board, and a water services committee...”

◆ **WSA:** A Water Services Authority is any District, Metropolitan or Local Municipality that is responsible for providing water services to end users.

◆ **Wastewater System:** A wastewater system is defined as the pipes, sewers, pumping stations and treatment works that collect, reticulate, and treat wastewater from residents, businesses, and industries before releasing or reusing the final treated effluent and biosolids.

Two different scorecards are used during the audit process, depending on the treatment technology employed:

- Basic system: This is typically a treatment works with entry level technology, limited/no mechanical components, such as evaporation ponds, oxidation ponds, maturation ponds, sludge lagoons, wetlands, and reedbeds. Basic systems are less complex, have less stricter requirements, and generally hold lesser risk to the environment and customer
- Advanced system: This is typically a works that employs more advanced forms of technology and comprise of several electrical, mechanical and instrumentation components, such as screening, de-gritting, biological filters, activated sludge systems, extended aeration, membranes, filters, belt presses, anaerobic digesters, UV disinfection, and pump stations. Advanced systems are generally more complex, hold potentially higher risk to the receiving environment, and are subject to stricter legal standards.

◆ **IRIS:** The Integrated Regulatory Information System (IRIS) is a web-based application used by the Department of Water & Sanitation to facilitate the relationship between Regulation and Management of water supply and wastewater systems, while also keeping relevant stakeholders informed on compliance trends of registered supply systems. Information is uploaded by the Water Services Institution onto IRIS to allow the Inspector to assess evidence before, during and after the

audit event. IRIS contains an inventory of information on all registered wastewater systems, tracks historic system performance, and provides the platform to register wastewater treatment works and operations staff.

- ◆ **Diagnostic:** A suite of key diagnostic themes covers a number of strategic areas of importance to the South African water industry. Diagnostics allows deeper examination of the data and a better understanding of the causes of behaviours and patterns, in answering pressing questions of “why did it happen?” and guide recommendations on “what correction or intervention is needed?”.

Green Drop Reporting

This Green Drop Report 2022 upholds the Minister’s commitment to provide the water sector and its stakeholders with **ongoing, current, accurate, verified, and relevant** information on the status of wastewater services in South Africa. It follows on a series of Green Drop Reports from 2009 to 2013, by providing feedback and progress pertaining to the current status of municipal, public, and selected private and state-owned wastewater facilities.



The Green Drop Report 2022 provides information on three different levels:

1. **System specific** data and information pertaining to the performance of each sewer network and treatment system at WSI level
2. **Province specific** data and information that highlight the strengths, weaknesses, and historic trends for the respective WSIs within a Province (WSA) or Region (DPW)
3. **National overview** that collates the findings from a provincial, regional and system levels to give an aggregated national perspective of wastewater service performance. Historic trends are provided to gain insight into the success of provincial and national strategies to improve wastewater management and to inform future strategies and interventions.

The final proof of greatness lies in being able to endure criticism without resentment.

Elbert Hubbard

2. GREEN DROP STANDARDS 2021

*The Stockdale paradox:
Confront the brutal truth of the situation, yet at the
same time, never give up hope.*



The Green Drop Audits were conducted by 24 audit panels comprising of qualified wastewater professionals. Each panel consisted of a Lead Inspector and 1-2 Inspectors. All inspectors underwent rigorous training and were required to achieve a threshold examination score to qualify for involvement in the audit process.

WSIs were supported and capacitated through the audit process. Provincial symposia, attended by WSIs from that province, were held prior to the audit to share information on the audit process and criteria. Information was also shared on the role of IRIS and introduction to the IRIS Helpdesk. WSIs were also notified in advance of the audit date, audit criteria and the required portfolio of evidence (PoE) for the audit to assist with their preparation. The period under review for the 2021 audit cycle was: 1 July 2020 to 30 June 2021.

The audit scorecard was designed to consider evidence against 5 Key Performance Areas (A-E). The Green Drop KPAs, weights, and standards are summarised in the section below. Each KPA and sub-criteria carry a different weighting and are based on the relative regulatory priorities. Annexure B provides guidance on the format and interpretation of the Report Card.

Green Drop 2021 Audit Period : 1 July 2020 – 30 June 2021

Green Drop Standards

KPA A: Capacity Management (15%)

A1) Registration of Wastewater Treatment Plant	The wastewater treatment facility is registered as per the requirements of Regulation 2834 or as per Green Drop Standard (Draft Regulation 813)
A2) Registration of Process Controllers and Supervisor	Process controllers and supervisors are classified as per Regulation 2834 or Draft Regulation 813 (Green Drop Standard). These requirements will apply for all shifts of a specific wastewater system.
A3) Maintenance Capacity	The wastewater system must be served by a competent maintenance team (internal or outsourced), executing the maintenance work according to an acceptable maintenance plan/schedule.
A4) Engineering Management Capacity	The WSI must ensure that a competent engineering specialist oversee wastewater treatment operations, maintenance, and general asset management.
A5) (Advanced Systems Only) Scientific Capacity (Sampling and Laboratory Information Management)	The WSI must ensure that a suitably qualified professional scientist oversee the implementation of the operational and compliance monitoring programme (sampling and analyses).

KPA B: Environmental Management (15%)

B1) Wastewater Risk Management	The WSI shall conduct a detailed environmental risk assessment for the entire sewer collection system, wastewater treatment (both effluent liquid and sludge) and identify adequate control measures to implement for each risk identified. This process should be collated in form of an implemented system specific Wastewater Risk Abatement Plan (W ₂ RAP) as per the Water Research Commission (WRC) guideline.
B2) Operational Monitoring	Each WWTW shall have an operational monitoring programme in place which informs the operational efficacy (as per the required frequency) of the treatment facility as per the Authorisation.
B3) Compliance Monitoring (Effluent)	Each WWTW shall have a compliance monitoring programme in place (implemented) which informs on the compliance with the site-specific Authorisation requirements (as per the required frequency, determinands and sampling sites) of the treatment facility as per the Authorisation.
	Sludge management (including sludge monitoring) must be implemented as per the Authorisation requirements.

B4) (Advanced Systems Only) Sludge Classification and Monitoring	
B5) Laboratory Credibility	All compliance monitoring samples must be analysed at a credible laboratory (either accredited according to SANAS requirements or participating in a Proficiency Testing scheme with acceptable z-scores) for the required determinands, with an acceptable turnaround time.

KPA C: Financial Management (20%)

C1) Wastewater Operations Cost Determination	The WSI must determine the actual operations and maintenance cost per wastewater scheme and express this in R/m ³ . Specific cost drivers need to inform the budget, including energy.
C2) Energy Demand	WSI must have proof of Energy Efficiency Management by providing Specific Power Consumption (SPC), energy unit cost (R/kWh), and express energy treatment cost in (R/m ³)
C3) Operations & Maintenance Budget	WSI must provide an annual O&M budget per wastewater system (for sewer collection network and wastewater treatment system).
C4) Operations & Maintenance Expenditure	WSI must provide proof of the wastewater system O&M expenditure per annum (to be measured in relation to the original budget).
C5) (Advanced Systems Only) Supply Chain Management of Services and Treatment Products	There must be appropriate supply chain management processes in place to ensure continuous availability of treatment chemicals (and related consumables), maintenance and spares.

KPA D: Technical Management (20%)

D1) Wastewater Treatment Works Design Capacity Management	For each wastewater treatment works, there must be continuous monitoring of daily hydraulic and organic loading in terms of the Average Dry Weather Flow (ADWF) and Chemical Oxygen Demand (COD) and compared with the design capacity.
D2) Process Audit	A wastewater treatment facility must be subjected to an annual condition assessment and/or a Process Audit (conducted by a duly qualified professional person) to inform functionality of the infrastructure. Risk findings must be incorporated in the W ₂ RAP process.
D3) Sewer Main Inspection	The Sewer Collection System must be subjected to an annual asset condition assessment (conducted by a duly qualified professional person), which includes a sewer pump-station functionality assessment and wastewater flow balance. Risk findings must be incorporated in the W ₂ RAP process.
D4) Wastewater Asset Register	Wastewater Infrastructure must be included in the WSI Asset Register (as per AGSA requirements), detailing: <ul style="list-style-type: none"> a) relevant equipment and infrastructure b) asset description c) location d) condition e) remaining useful life f) replacement value.
D5) (Advanced Systems Only) Bylaws and Enforcement (Local Regulation)	Municipalities must have enforceable bylaws in place which will safeguard advanced wastewater treatment technologies from harmful influent which would pose a risk to biological treatment processes and receiving environment (where authorised decentralised systems are being used).

KPA E: Effluent and Sludge Compliance (30%)

E1) Monitoring Data Submission to DWS	A WSI must ensure that all Compliance Monitoring data is submitted on a monthly basis to the Department of Water and Sanitation on the required Regulatory System (IRIS).
E2) Water Use Authorisation	The Section 21 water use must be authorised in terms of the National Water Act (Act 36 of 1998)

E3) Effluent Quality Compliance	The effluent quality must comply to 90% (in total) with the authorised limits for the respective categories: a) 90% Microbiological Compliance b) 90% Chemical Compliance c) 90% Physical Compliance
E4) (Advanced Systems Only) Sludge Quality Compliance	The solids/sludge must be classified as per WRC Sludge Guideline

Bonuses (Maximum of 15%)

F1) Process Control Training	Process controllers and supervisory staff must be subjected to relevant training over the past 24 months as from the date of audit. Cross-pollination and in-house training will be acknowledged as non-accredited capacity building.
F2) Stormwater Management	The WSI must have a Stormwater Ingress Management Plan detailing how stormwater (and other extraneous flow e.g. groundwater) entry is quantified, managed, and monitored to prevent entry into sewer systems.
F3) Water Demand Management	WSI shall formulate and implement a Water Conservation and Water Demand Management Plan which provides a strategy and work plan that identify, quantify, monitor, and manage leakages and water losses of any kind that may create an artificial water demand due to higher hydraulic loading of wastewater collection and treatment infrastructure.
F4) Wastewater and Sewer Capital Projects planned for upgrades or refurbishment	An approved business plan for sewer and/or wastewater upgrades or refurbishment, with secured/confirmed funding.
F5) Sludge Reuse	Plant-specific initiatives that contribute to wastewater resource recovery and climate resilience objectives: energy efficiency, energy generation, beneficial use of sludge, effluent, nutrients, etc.
F6) Additional Impact Monitoring	Plant-specific monitoring of environmental or control sites/location, e.g. groundwater, up-stream / downstream impact monitoring, and soil analysis

Penalties (Maximum of 15%)

G1) Wastewater Treatment Works operating beyond hydraulic design capacity	See D1. <i>Note: If the plant operates above its installed capacity, but the effluent quality complies on ALL 3 categories, only 50% of the penalty will be applied.</i>
G2) Any Sewer Collector & Pump-station dysfunctionality causing long term spillage	See D3. <i>Note: Should a WSI have proof of a response to a reported spillage as per its own Incident Management Protocol, within 7 days, then the penalty will not apply. If evidence of a long-term spill is observed during the TSA check of the network, a penalty will be applied, and possibly replicated to other systems in this WSI jurisdiction (Inspector discretion).</i>
Disqualifier	H1) Withholding or falsifying information
	H2) Directive Status (Non reaction to a Directive issued by the Department)

A final **effluent quality disqualifier** is applied during the 2021 audit. Wastewater systems qualify for Green Drop Certification status when achieving an audit score of $\geq 90\%$. However, if such system fails to achieve $\geq 90\%$ in microbiological and/or chemical compliance, the system would be disqualified from Certification and the score adjusted to 89%. The system will then be acknowledged as a Green Drop Contender. The adjustment will transfer to the institutional Green Drop score as well. The purpose of the disqualifier is to ensure that the credibility of the programme stays intact **in pursuit of excellence**. A system is only regarded as excellent if final effluent quality meets the excellence standards.

- ✘ Microbiological quality is selected for its importance in safeguarding the health of the downstream user and the integrity of the water resource. The presence of pathogens and bacteriological indicators in the final effluent implies that disinfection and nutrient removal operations of a treatment works are not optimised or functional.
- ✘ Chemical quality is selected for its negative impact on the water quality of the receiving waterways into which treatment works release final effluent. The presence of nitrogen and phosphate causes enrichment of inland and coastal waters. This leads to low-oxygen waters and dominance of certain algae and organisms, which leads to biodiversity losses, loss of fishery resources, seagrass, corals, and other aquatic life.

“If you are going to achieve excellence in big things, you develop the habit in little matters. Excellence is not an exception, it is a prevailing attitude.”

Colin Powell

3. NATIONAL GREEN DROP REPORT 2022

National Green Drop Report 2022

The National Green Drop Report 2022 is available from the Department of Water and Sanitation homepage. It can be accessed via www.dow.gov.za that will route the user to <https://ws.dws.gov.za/IRIS/LatestResults.aspx>

The DPW Green Drop Report 2022 is a sub-set of the national report and provides a regional perspective with detailed results and findings of each DPW Region.

The national report also contains conclusions, recommendations, and way forward for the country and for provinces/regions as a collective.



We will use this report as the baseline for the Water Services Improvement Programme (10-point plan) from where we will measure the sustainable turn-around which we aspire to. We move forward knowing that we do not accept 'being good' as the norm for the South African wastewater industry instead, we endeavour towards excellence.

Minister for Water and Sanitation: Mr Senzo Mchunu

4. DEPARTMENT OF PUBLIC WORKS: WASTEWATER MANAGEMENT PERFORMANCE



Department of Public Works Synopsis

An audit attendance record of 100% affirms the DPW Regions commitment to the Green Drop national incentive-based regulatory programme.

The Regulator determined that no wastewater systems scored a minimum of 90% when measured against the Green Drop standards for the audited period and thus no DPW region qualified for the prestigious Green Drop Certification. This is consistent with no systems being awarded Green Drop Status in 2013 but is recognised for its inherent value to establish an accurate, current baseline from where improvement can be driven, and excellence be incentivised.

Five (5) of the 12 DPW Regions improved on their 2013 scores. The remainder of the DPW Regions relapsed to lower Green Drop scores compared to 2013 baselines. The Eastern Cape Port Elizabeth Region is the best performing Region with a Green Drop score of 45%, supported by a good technical site assessment score of 81% for St Albans Prison. PE also achieved the best overall progress from an 8% GD score in 2013 to 45% in 2021. Western Cape and Johannesburg are in 2nd and 3rd positions but are marked by low Green Drop and TSA score. Unfortunately one hundred and two (102 of 115) systems were identified in critical state in the DPW, compared to 104 of 121 systems in 2013.

The full range of Green Drop KPAs require attention from all the DPW Regions, without any exceptions. It is recommended that the national DPW programme of 2018 be revitalised to turnaround wastewater services in DPW, building on the 2021 audit baseline.

It needs mention that DPW leadership commissioned a nation-wide project in 2017 to get DPW Regions ready for the next Green Drop audit. Most of the Green Drop information was prepared during this project, but not all Regions presented this information as evidence. Amongst others, Sludge Management Plans were prepared which contain the technology and design of the treatment facilities.

The provincial Risk Ratio for treatment plants regressed from 80% in 2013 to 88% in 2021. The most prominent risks were observed on treatment level, and pointed to works that exceeded their design capacity, dysfunctional processes, and equipment (especially disinfection), and effluent and sludge non-compliance. Opportunities are presented in terms of reducing cost through process optimisation and improved energy efficiency, and beneficial use of sludge, nutrients, biogas, and other energy resources.

The Regulator is hopeful that the 2021 audits will set a baseline from where a positive trajectory for wastewater services and improved performance will follow. The DPW Regions are encouraged to start preparation for the 2023 Green Drop audit. The 2021 Green Drop status are summarised in Table 1, indicating no Green Drop Certifications, but several systems in critical state.

Table 1 - 2021 Green Drop Summary

DPW Region	2013 GD Score (%)	2021 GD Score (%)	GD Certified ≥90%	GD Contenders (89%)	Critical State (<31%)
Eastern Cape PE	8	45↑			Bulembu SAPS Airport
Western Cape	42	22↓			10 of 11 plants
Gauteng Johannesburg	0	22↑			Devon
Mpumalanga	28	21↓			6 of 8 plants
North West	0	18↑			All 10 plants
Gauteng Pretoria	1	13↑			All 8 plants
Free State	14	7↓			All 6 plants
Northern Cape	18	6↓			All 6 plants
Eastern Cape Mthatha	2	4↑			All 16 plants
Limpopo	15	3↓			All 20 plants
KwaZulu Natal North		0↓			All 13 plants
KwaZulu Natal South	19	14↓			All 5 plants
Totals	-	-	0	0	102

The Department of Water and Sanitation acknowledges the excellence in wastewater management achieved for the Green Drop Audit year of 2021.

No Green Drop Certificates are awarded in any of the DPW Regions.



Background to Department of Public Works Wastewater Services

Incentive based regulation was an innovative and uniquely South African response to challenges in the water sector. The tragedies of Delmas (2005 and 2007) and Joe Gqabi (2007) showed that an alternative, proactive approach to regulation was required to improve the standards of drinking water and wastewater management. This was the genesis of the Blue Drop (Drinking Water) and Green Drop (Wastewater Quality) programmes in 2008.

Incentive-based regulation seeks to induce changes in behaviour of individuals and institutions to facilitate continuous improvement and adoption of best practice management of treatment systems. Consequently, progressive improvement and excellent performance is recognised and rewarded. It should however not be construed as a weaker form of regulation but rather an alternate approach, as it is underpinned by a strong legislative mandate in the Water Services Act.

The Green Drop and Blue Drop incentive-based regulation promotes transparency and accountability and allows DWS to measure, monitor and publish information about the quality of water services, based on legislative standards or industry good practice. It seeks to identify risks and to ensure responsible authorities implement control measures to prevent failure.

There are 12 DPW Regions in South Africa, delivering wastewater services through a sewer network comprising of 115 wastewater treatment systems, 73 network pumpstations and 35.2 km outfall and main sewer pipelines. The sewer network excludes the pipelines of 8 DPW Regions who could not provide data. There is a total installed treatment capacity of 39.04 Ml/d, with all capacity residing in micro-, small, and medium-sized treatment plants. No large or macro-sized plants are used.

Table 2 - Summary of WWTW capacity and flow distribution according to plant sizes

	Micro Size Plants	Small Size Plants	Medium Size Plants	Unknown (NI)*	Total
	<0.5 MI/day	0.5-2 MI/day	2-10 MI/day		
No of WWTW	64	27	4	26	115
Total Design Capacity (MI/day)	7.67	20.37	11.00	26	39.04
Total Daily Inflow (MI/day)	1.93	11.07	3.38	70	18.03
Use of Design Capacity (%)	25%	54%	31%	-	46%

* "Unknown" means the number of WWTWs with NI (No Information) on design capacity or daily inflow

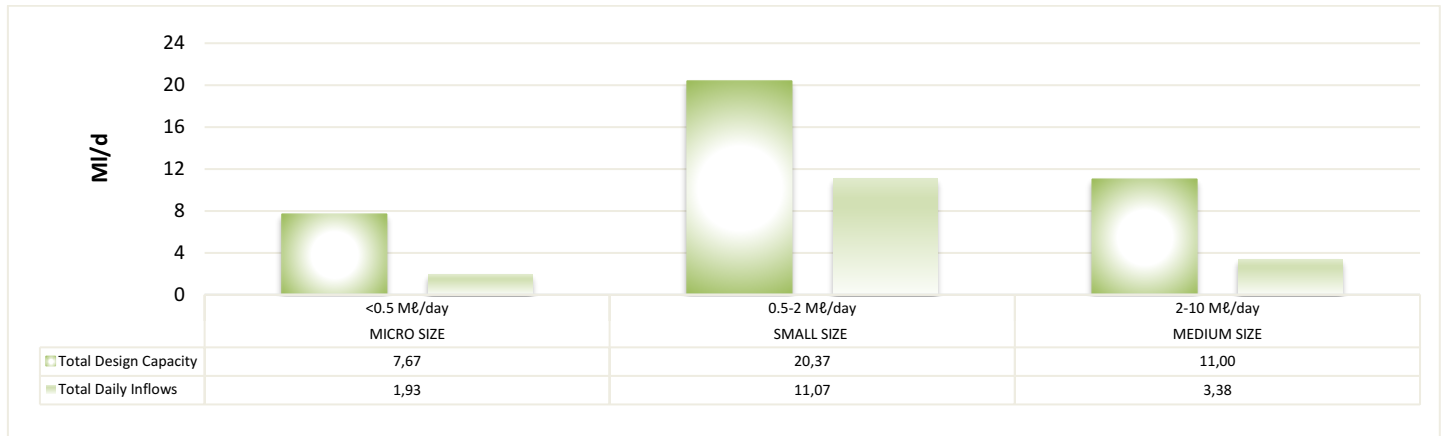


Figure 1 - Design capacities and operational inflow to WWTWs

Based on the current operational flow of 18.03 MI/d, the treatment facilities are operating at 46% of their design capacity. The three largest flow contributors are the Western Cape, Eastern Cape, and Free State Regions with a total of 11.9 MI/d. The 46% figure implies that there is 54% spare capacity to meet the medium-term demand. However, 70 of the 115 systems (61%) do not monitor their inflow. The spare capacity is therefore inaccurate and can only be confirmed once all WWTWs measure their inflow (Refer to Diagnostic 3). The spare capacity would also be compromised at systems in cases where treatment processes are non-operational due to dysfunctional equipment and/or structures. VROOM Cost Diagnostic 7 reports on the refurbishment requirements to restore such capacity and functionality. The "available" capacity translates to 21 MI/day, which would be sufficient to service an additional 87,500 to 131,250 persons (Red Book, 2019: 40-60% of 400 l/c/d).

The audit data shows that 8 systems with known design capacities are hydraulically overloaded. This figure will be higher as there are 70 systems that are not measuring their inflows and hence it is not possible to determine whether these systems are hydraulically overloaded as well. The systems with known design capacities, that are hydraulically overloaded, are as follows:

- Eastern Cape Mthatha: 1 of 16 systems (Willowvale DCS)
- Free State: 1 of 6 systems (Goedemoed Correctional Centre)
- KZN South: 1 of 5 systems (New Hanover prison)
- Mpumalanga: 1 of 8 systems (Lebombo PoE)
- Western Cape: 4 of 11 systems (Voorberg, Brandvlei, Dwarsrivier and Drakenstein Prisons).

The predominant treatment technologies employed at WWTWs comprise of ponds/lagoons, activated sludge and variations, rotating biological contactors and biofilters (for effluent treatment), and solar drying beds for sludge treatment. The next audit will need to verify sludge treatment technologies, as insufficient information ("None") is observed in this area.

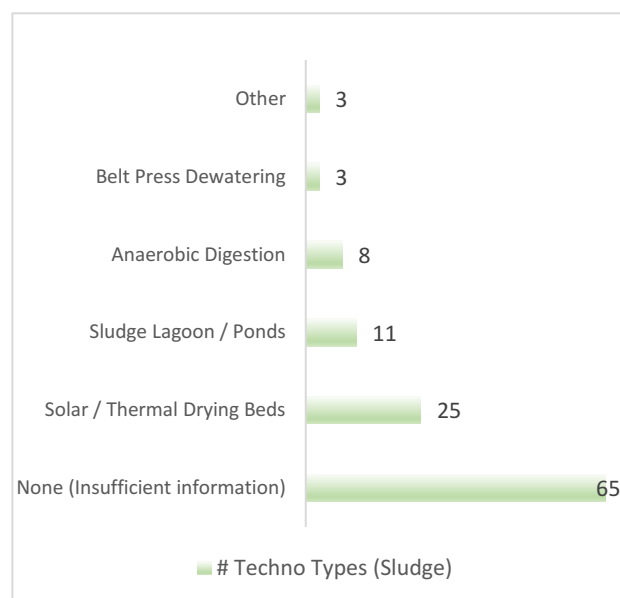
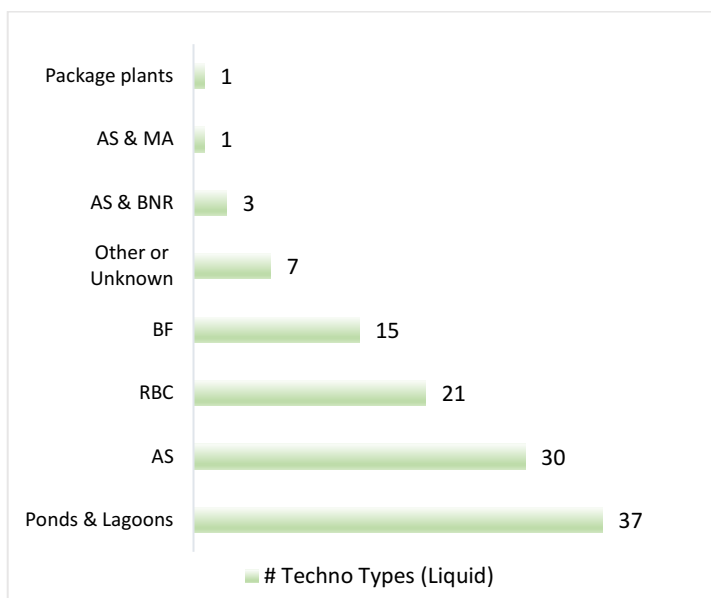


Figure 2 - Treatment technologies for wastewater effluent (a) and sludge (b)

Table 3 - Summary of Collection Network Pump Stations and Sewer Pipelines

DPW Region	# WWTWs	Pump Stations (#)	Sewer Pipelines (km)
Eastern Cape Mthatha	16	0	NI
Eastern Cape PE	11	6	29
Free State	6	7	NI
Gauteng Pretoria	8	4	NI
Gauteng Johannesburg	1	1	NI
KwaZulu Natal North	13	17	0.2
KwaZulu Natal South	5	2	NI
Limpopo	20	0	NI
Mpumalanga	8	1	NI
North West	10	2	2
Northern Cape	6	10	NI
Western Cape	11	23	4
Totals	115	73	35.2

The sewer network consists of the sewer mains and pumpstations as summarised in Table 3. The Western Cape Region appears to have the most pump stations (23 no.) followed by KwaZulu Natal North Region (17 no.) Only the Eastern Cape provided verifiable information on the length of sewer pipelines in the Region (29 km). Eight of the 12 Regions could not provide information on sewer pipelines, indicating asset management information limitations.

Department of Public Works Green Drop Analysis

The 100% response from the 12 DPW Regions audited during the 2021 Green Drop process demonstrates a commitment to wastewater services in the country.

Table 4 - Green Drop Comparative Analysis from 2009 to 2021

GREEN DROP COMPARATIVE ANALYSIS				
Performance Category	2009 - 2011	2013	2021	Performance trend 2013 and 2021
Incentive-based indicators				
DPW Regions assessed (#)	Not determined	12 (100%)	12 (100%)	→
Wastewater systems assessed (#)	Not determined	121	115	↓
Average Green Drop score	Not determined	13.9%	12.3%	↓
Green Drop scores ≥50% (#)	Not determined	5/121 (4%)	2/115 (2%)	↓
Green Drop scores <50% (#)	Not determined	116/121 (96%)	113/115 (98%)	↓
Green Drop Certifications (#)	Not determined	0	0	→
Technical Site Inspection Score (%)	Not determined	47.1%	45.3%	↓

NA = Not Applied NI = No Information

↑ = improvement, ↓ = regress, → = no change

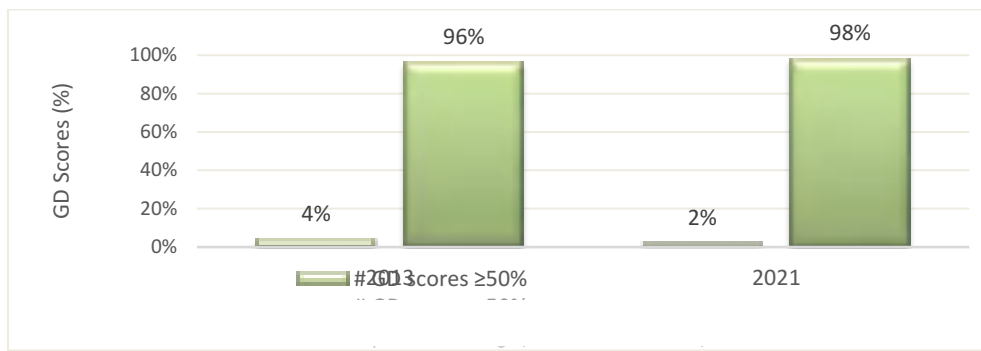


Figure 3 - GD trend analysis over the period 2013 to 2021, indicating the percentage GD scores above 50% (left bar) and below 50% (right bar)

The trend analysis indicates that:

- The number of systems audited has decreased from 121 systems in 2013, when the first assessments were undertaken, to 115 systems in 2021
- The GD average score decreased marginally from 14% in 2013 to 12% in 2021
- Similarly, the number of systems with GD scores of $\geq 50\%$ decreased between from 5 (4%) in 2013 to 2 (2%) in 2021
- This trend was also mirrored in the Technical Site Assessment score, which had decreased marginally from 47% in 2013 to 45% in 2021
- This trend was balanced by the number of systems with GD score of $\leq 50\%$ increasing from 96% in 2013 to 98% in 2021
- The Green Drop Certifications remained constant with 0 awards in 2013 and 0 awards in 2021.

The analysis for the period 2013 to 2021 indicates that the majority of the system scores are in the 0-31% (Critical Performance) space, with the 31-49% (Poor Performance) being the next largest category.



Figure 4 - No. WWTWs in the Green Drop score categories over the period 2013 to 2021 (graph legend to right)

90 – 100% Excellent	■
80-<90% Good	■
50-<80% Average	■
30-<50% Poor	■
0-<31% Critical state	■

In summary, trends for the period 2013 to 2021 indicate as follows:

- Systems in a 'poor state' decreased from 12 systems in 2013 to 11 systems in 2021
- Systems in a 'critical state' decreased from 104 in 2013 to 102 systems in 2021
- Systems in the 'excellent and good state' remained constant with no systems in 2013 and 2021.

Department of Public Works Risk Analysis

Green Drop risk analysis (CRR) focuses on the treatment function specifically. It considers 4 risk indicators, i.e. design capacity, operational flow, technical capacity, and effluent quality. The CRR values do not factor risks associated with sanitation- or wastewater network and collector systems.

Table 5 - Cumulative Risk Comparative Analysis from 2013 to 2021

Performance Category	2013	2021	Performance Trend
Highest CRR	17	17	→
Average CRR	13.6	15.0	↓
Lowest CRR	6	6	→
Design Rating (A)	1.0	1.0	→
Capacity Exceedance Rating (B)	4.5	4.2	↑
Effluent Failure Rating (C)	5.3	7.3	↓

Performance Category	2013	2021	Performance Trend
Technical Skills Rating (D)	3.8	3.5	↑
CRR% Deviation	80.0	88.0	↓

↑ = improvement, ↓ = regress, → = no change

The concept of risk management has not been embedded within the DPW Regions. Table 5 shows a regressed CRR% deviation from 2013 (80%) to 2021 (88%) for the Regions overall, mostly as result of final effluent quality failures (C). The other risk indicator shows little- or even positive risk changes, i.e. no change in design capacity (A), risk improvement in design capacity exceedance (B) and improvement in the technical skills rating (D). Individual systems, however, shows more pertinent risk vulnerabilities, as highlighted under **“Regulator’s Comment”** for each wastewater system. The CRR analysis in context of the Green Drop results suggests that further improvements should focus on 1) capacity exceedance at plants which are hydraulically overloaded or approaching its design lifespan, 2) effluent quality failures, especially for microbiological compliance, and 3) strengthening of technical skills and operational competency, especially related to sludge management.

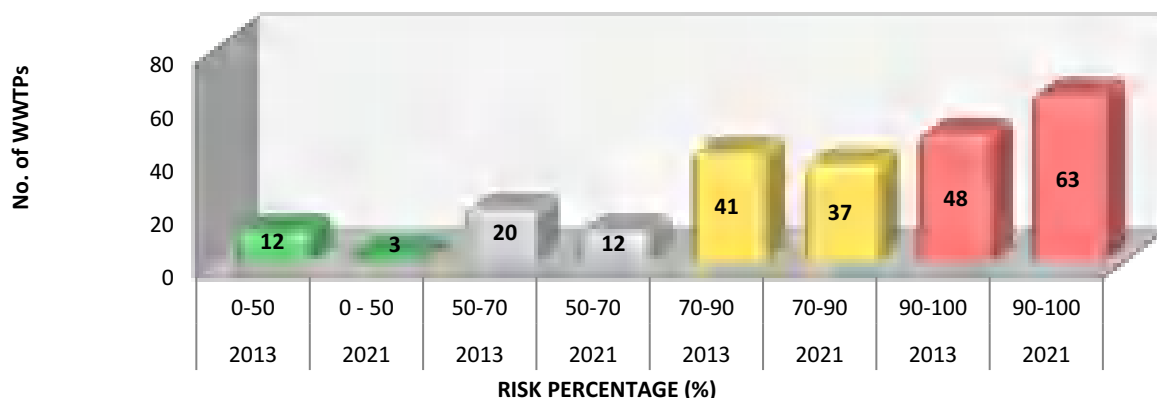


Figure 5 - WWTW Risk distribution and trends from 2013 to 2021; Colour legend

90 – 100% Critical risk WWTWs	Red
70 - <90% High risk WWTWs	Yellow
50-<70% Medium risk WWTWs	Grey
<50% Low risk WWTWs	Green

Trend analysis of the CRR ratings for the period 2013 to 2021 reveals that:

- The 2021 assessment cycle highlighted regressive shifts with a decrease in the number of low risk WWTWs (12 to 3), decrease in medium risk WWTWs (20 to 12), decrease in high risk WWTWs (47 to 37), followed by a marked increase in critical risk WWTWs (48 to 63)
- This is a highly concerning trend that would require urgent intervention by DPW leadership
- An overall regressive performance pattern is noted in most DPW works, which signal the benefit of repeat/regular audits to ensure continued improvement. Performance seems to decrease when there are significant time lapses or irregular interaction.

Regulatory Enforcement

Wastewater systems which **failed to achieve the minimum Green Drop target of 31%**, are placed under **regulatory focus**. The Regulator requires that the DPW Regions to submit a detailed corrective action plan within 60 days of publishing of this report. Without any exception, all DPW Regions and 102 wastewater systems received Green Drop scores below 31%. These systems are placed under **regulatory surveillance**, in accordance with the Water Services Act (108 Of 1997). In addition, these DPW Regions will be compelled to ringfence water services funding or grant allocations to rectify and restore wastewater collection and treatment shortcomings identified in this report.

Table 6 - WWTWs with <31% Green Drop scores

DPW Region	2021 GD Score	WWTWs with <31% score
Eastern Cape Port Elizabeth	45%	Bulembu SAPS Airport
Western Cape	22%	10 of 11 plants
Gauteng Johannesburg	22%	Devon
Mpumalanga	21%	6 of 8 plants
North West	18%	All 10 plants
KwaZulu Natal South	14%	All 5 plants
Gauteng Pretoria	13%	All 8 plants
Free State	7%	All 6 plants
Northern Cape	6%	All 6 plants

DPW Region	2021 GD Score	WWTWs with <31% score
Eastern Cape Mthatha	4%	All 16 plants
Limpopo	3%	All 20 plants
KwaZulu Natal North	0%	All 13 plants

The following DPW Regions and their associated wastewater treatment plants are in high CRR risk positions, which means that some or all the risk indicators are in a precarious state, i.e. operational flow, technical capacity, and effluent quality. WWTWs in high risk and critical risk positions poses a serious risk to public health and the environment. The following DPW Regions will be required to assess their risk contributors and develop corrective measures to mitigate these risks.

Table 7 - %CRR/CRR_{max} scores and WWTWs in critical and high-risk space

DPW Region	2021 CRR/CRR _{max} % deviation	WWTWs in critical and high-risk space	
		Critical Risk (90-100%CRR)	High Risk (70-<90%CRR)
EC Port Elizabeth	64.2%		4 Plants
MP	70.6%		5 Plants
WC	73.0%	1 Plant	5 Plants
GP Johannesburg	77.0%		1 Plant
NC	83.0%		6 plants
FS	84.0%		6 Plants
EC Mthatha	91.2%	7 Plants	9 Plants
NW	92.0%	9 Plants	1 plant
KZN South	98.0%	5 Plants	
GP Pretoria	100.0%	8 Plants	
KZN North	100.0%	13 Plants	
LP	100.0%	20 Plants	

Good practice risk management requires that the W₂RAPs are informed by meaningful Process and Condition Assessments, supported by zealous implementation of corrective measures and ongoing monitoring of risk movement. All of the 12 DPW Regions have wastewater systems in the high and critical risk positions, 63 systems in critical risk positions and 37 plants in high-risk positions (100 of the 115 systems in total). It is evident that risk management has not sufficiently been embedded in any of the Regions, and would require a concerted effort, such as the revival of the national DPW programme of 2018.

Performance Barometer

The **Green Drop Performance Barometer** presents the individual Green Drop Scores, which essentially reflects the level of mastery that a Region has achieved in terms of its overall wastewater services business. The bar chart below indicates the GD scores for 2013 in comparison to GD 2021, from highest to lowest performing DPW Region. The Eastern Cape PE Region is commended for an improved GD score from 8% in 2013 to 45% in 2021 and is also the only Region which improved its overall CRR risk status. The Western Cape Region relapsed from 42% in 2013 to 22% in 2021. All the other DPW Regions remain in critical state.

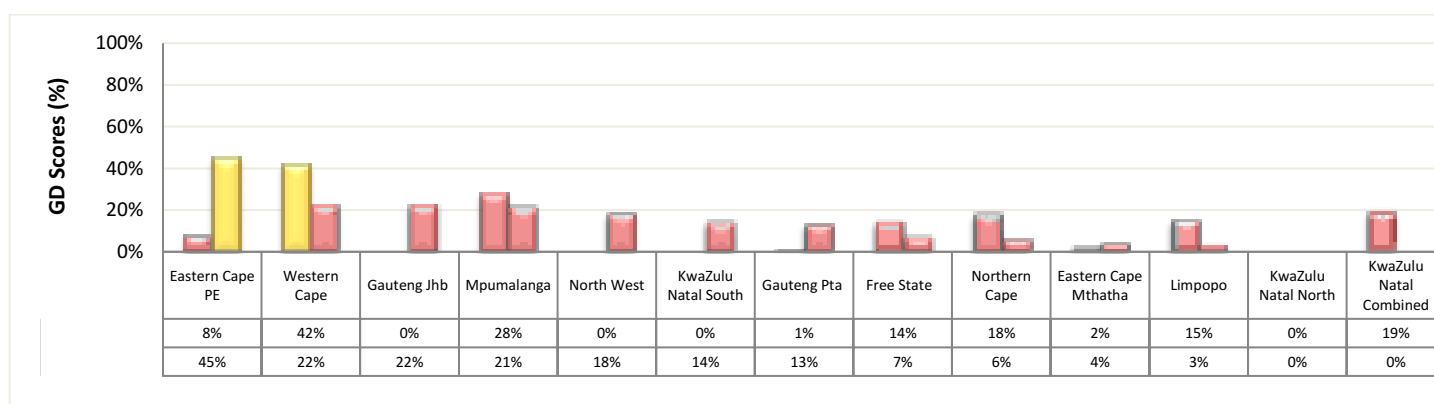


Figure 6 - a) Green Drop scores 2013 (bar left) and 2021 (bar right), with colour legend inserted

90 – 100% Excellent	Blue
80-<90% Good	Green
50-<80% Average	Grey
30-<50% Poor	Orange
0-<31% Critical state	Red

The **Cumulative Risk Log** expresses the level of risk that a Region poses in respect its wastewater treatment facility. It is based on the **individual Cumulative Risk Ratios**. Figure 7 presents the cumulative risks in ascending order – with the low-risk DPW Regions on the left and critical risk DPW Regions to the far right. The analysis reveals that there are 5 DPW Regions in high-risk positions and 6 DPW Regions in critical risk positions. Only Eastern Cape is maintaining a good risk status, being in medium risk space.

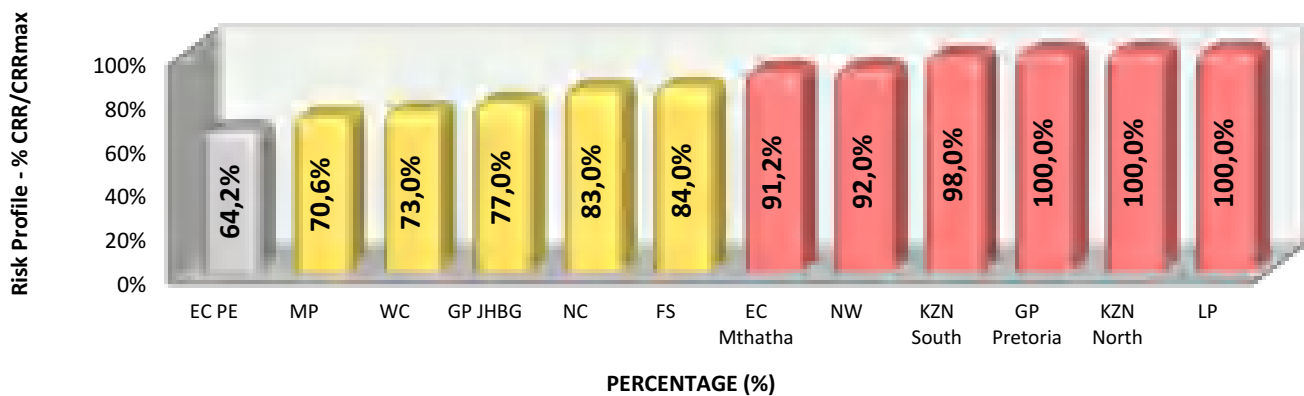


Figure 7 - %CRR/CRRmax Risk Performance Log 2021; Colour legend

90 – 100% Critical risk WWTPs	Red
70 - <90% High risk WWTPs	Yellow
50-<70% Medium risk WWTPs	Grey
<50% Low risk WWTPs	Green

Department of Public Works Best Performers

Eastern Cape Port Elizabeth received the highest Green Drop score for all DPW Regions:

- ✓ 45% Green Drop Score
- ✓ 2013 Green Drop Score of 8%
- ✓ Improvement on the CRR risk profile from 87% in 2013 to 64% in 2021
- ✓ 7 of 11 systems in the low and medium risk positions
- ✓ Technical Site Assessment score of 81% (St Albans Prison)

Western Cape received the 2nd best Green Drop score:

- ✓ 22% Green Drop Score
- ✓ 5 of 11 systems in the low & medium risk positions
- ✓ TSA score of 49% (Drakenstein Prison)

Gauteng Johannesburg received the 3rd best Green Drop score:

- ✓ 22% Green Drop Score
- ✓ 1 system in high-risk position
- ✓ TSA score of 66% (Devon)

KPA Diagnostics

The Green Drop Audit process collects a vast amount of data that yield valuable insight on the state of the wastewater sector in each Region. These insights have been captured into 7 thematic areas or ‘Diagnostics’, as discussed below.

Table 8 - Summary of the key diagnostic themes and reference to the respective Green Drop KPAs

Diagnostic #	Diagnostic Description	Diagnostic Reference
1	Green Drop KPA Analysis	KPAs A-E
2	Technical Competence	KPA A, B & Bonus
3	Treatment Capacity	KPA D
4	Wastewater Monitoring and Compliance	KPA B & D & Bonus
5	Energy Efficiency	KPA C & Bonus
6	Technical Site Assessments	TSA
7	Operation, Maintenance and Refurbishment of Assets	KPA C, D & Bonus

Diagnostic 1: Green Drop KPA Analysis

Aim: Analysis of technical skills, environmental plans, financial management, technical capacity, and regulatory compliance provides insight to the strengths and weaknesses that distinguish the DPWs wastewater industry.

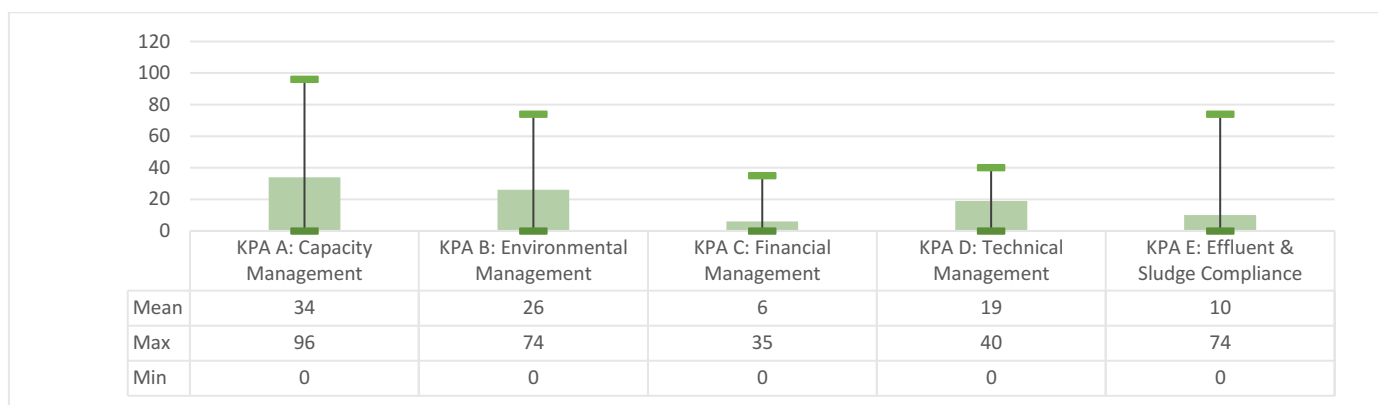
These insights in return, may inform appropriate interventions and strategies to improve the individual KPAs and ultimately, collective KPA performance.

Findings: The DPW Regions are characterised by a highly variable KPA profile. A good KPA profile typically depicts a high mean GD score, coupled with a low Standard Deviation (SD) between the outer parameters (min and max). Similarly, a well performing system is one which has most/all systems in the >80% bracket and no systems in the <31% bracket.

Table 9 - Green Drop scores KPA profiles (graph legend included)

KPA #	Key Performance Area	Weight	Minimum GD Score (%)	Maximum GD Score (%)	Mean GD Score (%)	# Systems <31%	# Systems ≥80%
A	Capacity Management	15%	0%	96%	34%	70 (61%)	11 (10%)
B	Environmental Management	15%	0%	74%	26%	72 (63%)	0 (0%)
C	Financial Management	20%	0%	35%	6%	115 (100%)	0 (0%)
D	Technical Management	20%	0%	40%	19%	100 (87%)	0 (0%)
E	Effluent and Sludge Compliance	30%	0%	74%	10%	105 (91%)	0 (0%)

90 – 100% Excellent	
80-<90% Good	
50-<80% Average	
30-<50% Poor	
0-<31% Critical state	



Note: The High and low lines represent the Min and Max range, and the shaded green represents the Mean

Figure 8 - Maximum, minimum, and mean Green Drop KPA scores

The KPA distribution indicates as follows:

- Capacity Management (KPA A) depicts the highest mean of 34%, the highest maximum of 96%, and the highest Standard Deviation (SD) of 96%. These results indicate some pockets of strengths pertaining to the registration of WWTWs, maintenance plans and records, maintenance teams, and registered, qualified staff (process controllers, supervisors, scientists, technicians, engineers)
- Financial Management (KPA C) received the lowest mean of 6%, indicating a deficiency in credible information pertaining to the budget drivers, O&M budgets and expenditure, operational cost (R/m³), energy use and cost (R/kWh), and supply chain management and contract management
- This was followed by the Effluent and Sludge Compliance (KPA E) that received the next lowest mean of 10%, indicating vulnerability in data management, IRIS upload, effluent quality compliance, and sludge quality compliance.

The GD bracket performance distribution echoes the above findings:

- **KPA Score ≥80%:** Capacity Management (KPA A) is by far the best performing KPA with 10% of systems achieving >80%. All the remaining KPAs achieved 0% of systems >80%
- **KPA Score <31%:** Financial Management (KPA C) represents the worst performing KPA with 100% of systems lying in the 0-31% bracket, followed by Effluent and Sludge Compliance (KPA E) with 91% and Technical Management (KPA D) with 87%.

Diagnostic 2: Technical Competence

Aim: This focus area assesses the human resources (technical) capacity to manage wastewater systems. Theory suggests that a direct correlation exists between human resources capacity (sufficient number of appropriately qualified staff) and a Region's performance- and operational capability. It is projected that high HR capacity would translate to compliant wastewater services and protection of scarce water resources.

Findings: According to regulations, wastewater plants are classified as Class A, B, C, D or E plants. Similarly, Process Controllers and Plant Supervisors are registered as Class I, II, III, IV, V or VI operators. High classed plants require a higher level of operators due to their complexity and strict regulatory standards. Technical compliance of PCs and Supervisors is determined against Green Drop standards, as defined by Reg. 2834 and draft Reg. 813 of the National Water Act 1998.

Note: "Compliant staff" means qualified and registered staff that meets the GD standard for a particular Class Works. "Staff shortfall" means staff that does not meet the GD standard for a particular Class of works (+1 for a shift) and/or staffing gaps exist at the respective WWTWs.

Table 10 - No. compliant versus shortfall in Supervisor and Process Controller staff

DPW Region	# WWTWs	Compliant staff		Staff Shortfall		Ratio*	2021 GD Score (%)
		Supervisor	PCs	Supervisor	PCs		
Eastern Cape Mthatha	16	0	0	3	16	0.0	4%
Eastern Cape Port Elizabeth	11	15	18	0	5	3.0	45%
Free State	6	0	3	2	13	0.5	7%
Gauteng Pretoria	8	0	2	3	12	0.3	13%
Gauteng Johannesburg	1	0	1	1	1	1.0	22%
KwaZulu Natal North	13	0	0	3	25	0.0	0%
KwaZulu Natal South	5	1	3	1	9	0.8	14%
Limpopo	20	0	0	6	37	0.0	3%
Mpumalanga	8	4	2	1	12	0.8	21%
North West	10	1	5	3	7	0.6	18%
Northern Cape	6	0	2	2	10	0.3	6%
Western Cape	11	1	2	3	18	0.3	22%
Totals	115	22	38	28	165		

* The single number Ratio is derived from the number of qualified staff divided by the number of WWTWs operated by this number of staff. E.g. for DPW-EC, 33 qualified staff is available to support 11 WWTW, thus $33/11 = 3$ ratio

Competent human resources are a vital enabler to ensure efficient and sustainable management of treatment processes and infrastructure. For the DPW, operational competencies are not on par with regulatory expectations, as illustrated by the high shortfalls against the Green Drop standards. This is possibly brought about by existing staff not being registered or qualified, but also by the high number of contractors that is not required to comply with regulatory standards. The latter could be addressed by including this requirement in the tender and procurement specification.



Figure 9 - Schematic illustration of compliant versus non-compliant Supervisors (a) and Process Controllers (b)

Plant Supervisors: The pie charts indicate that 44% (22 of 50) of Plant Supervisors complies with the Green Drop standard, with zero shortfall for the Eastern Cape PE Region. A 56% (28 of 50) shortfall is noted for Supervisors overall, with the highest shortfall observed for the Limpopo Region (6 no.) and 5 of the other DPW Regions with 3 no. each.

Process Controllers: Similarly, 19% (38 of 203) of the PC staff is compliant for the DPW Regions. There is an 81% (165 of 203) shortfall in PCs with the highest shortfall in the Regions for Limpopo (37 no.), followed by KwaZulu Natal North (25 no.), Western Cape (18 no.), and Eastern Cape Mthatha (16 no.).

Green Drop standards prescribes stricter standards for Class A and B plants with Level V and VI Supervisors and Process Controllers per shift, whereas Class C to E plants have reduced requirements and sharing of staff across works is acceptable. The introduction of shifts is necessary to ensure that expensive assets are not left unsupervised during night times, especially considering issues of operations and vandalism. Telemetry also reduces the requirement for on-site staff during night shifts, but any relaxations need to be resolved with DWS.

It is anticipated, but has never been tested before, that a close correlation would exist between the competence of an operational team and the performance of a treatment plant, as measured by the GD score. The data indicates as follows:

- 1 of the 12 DPW Regions have good Supervisor/Process Controller ratios in place (≥ 3) – Eastern Cape PE
- All the DPW Regions have shortfalls in registered Process Controllers.

The results from the ratio analysis indicate high ratios for Eastern Cape PE only, and low ratios for the remaining Regions.

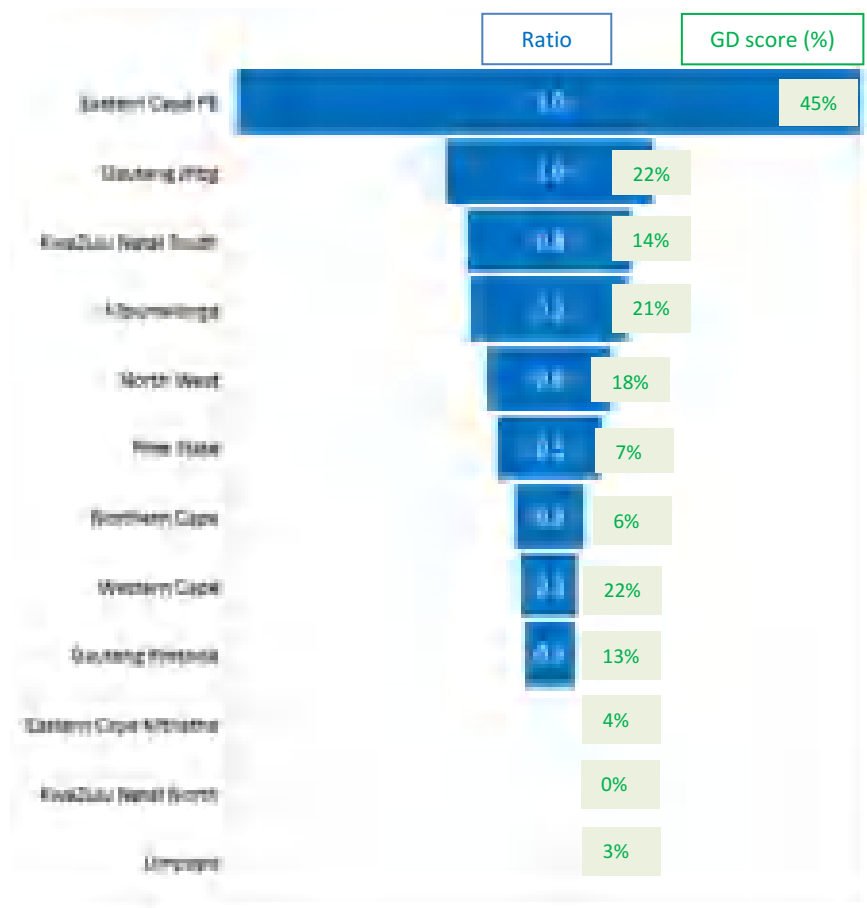


Figure 10 - Ratio of compliant operational staff to no. of WWTWs and Comparison of Ratios with GD scores

Overall, the comparative bar chart confirms a high correlation between Regions with high ratios and higher GD scores (Eastern Cape PE 45%, Gauteng Johannesburg 22%, Mpumalanga 21%, and North West 18%). Whereas lower ratios are associated with lower GD scores, i.e. Free State to Limpopo in Figure 205, with the only anomaly being that of the Western Cape.

In addition to operational capacity (above), good management practice also requires access to qualified engineers, technicians, technologists, scientists, and maintenance capability. Such competencies could reside in-house or accessible through term contracts and external specialists.

Table 11 - Summary of the maintenance capacity and no. of qualified and shortfall of Engineering, Technical and Scientific staff

DPW Region	# WWTW	Maintenance Arrangement	Qualified Technical Staff (#)				Technical Shortfall (#)	Qualified Scientists (#)	Scientists Shortfall (#)	Ratio*	2021 GD Score (%)
			Engineers	Technologists	Technicians	Total					
Eastern Cape Mthatha	16	No Capacity	0	0	0	0	2	0	1	0.0	4%
Eastern Cape Port Elizabeth	11	Inadequate Capacity; Internal Team (Only)	1	0	0	1	1	4	0	0.1	45%
Free State	6	Inadequate Capacity; Partially Capacitated	1	2	1	4	0	0	1	0.7	7%
Gauteng Pretoria	8	Partially Capacitated	0	0	0	0	2	1	0	0.0	13%
Gauteng Johannesburg	1	Internal + Term Contract	0	1	0	1	1	0	1	1.0	22%
KwaZulu Natal North	13	Internal + Specific Outsourcing	0	0	0	0	2	0	1	0.0	0%
KwaZulu Natal South	5	No capacity	0	0	1	1	1	0	1	0.2	14%
Limpopo	20	No Capacity	0	0	0	0	2	0	1	0.0	3%
Mpumalanga	8	Internal Team (Only); Internal + Term Contract	1	0	0	1	1	0	1	0.1	21%
North West	10	Internal + Term Contract; Internal Team (Only); Internal + Specific Outsourcing	1	0	0	1	1	1	0	0.1	18%
Northern Cape	6	Internal + Specific Outsourcing; No Capacity	0	0	0	0	1	1	0	0.0	6%
Western Cape	11	Inadequate Capacity; Partially Capacitated	0	0	0	0	0	3	0	0.0	22%
Totals	115		4	3	2	9	14	10	7		

* The Ratio depicts the number of qualified technical staff divided by the number of WWTWs that have access to the staff

Note 1: "Qualified Technical Staff" means staff appointed in positions to support wastewater services, and who has the required qualifications. "Technical Shortfall" is calculated based on a minimum requirement of at least 2 Engineers/Technologists/Technicians and at least one 1 Scientist per DPW Region.

Note 2: "Qualified Scientists" means professional registered scientists (SACNASP) appointed in positions to support wastewater services. "Scientist's shortfall" means that the WSI does not have at least one qualified, SACNASP registered scientist in their employ or contracted.

The DPW has a low contingent of qualified maintenance staff for at least 5 of the 12 DPW Regions, with the current qualified maintenance staff forming a collective of in-house-, contracted- or outsourced personnel. The data for maintenance capacity and expertise indicates the following:

- 6 of 12 DPW Regions have in-house maintenance teams
- 3 of 12 DPW Regions have internal maintenance teams supplemented with term contracts
- 3 of 12 DPW Regions have internal maintenance teams supplement with specific outsourced services
- 8 of 12 DPW Regions range from no capacity to inadequate capacity to partially capacitated.

For qualified technical staff in the DPW Regions, the data indicates as follows:

- A total of 4 engineers, 3 technologists, 2 technicians (qualified) and 10 SACNASP registered scientists are assigned to the 12 DPW Regions, totalling 19 qualified staff for the DPW
- A total shortfall of 21 persons is identified, consisting of 14 technical staff and 7 scientists
- 10 of the 12 DPW Regions have some shortfall in qualified technical staff, with the exception of the Free State and Western Cape Regions
- Only 25% (3 of 12) of the DPW Regions have access to credible laboratories which complies with Green Drop standards. The DPW in-house laboratories are generally found to lack quality assurance and adequate analytical turnaround times.

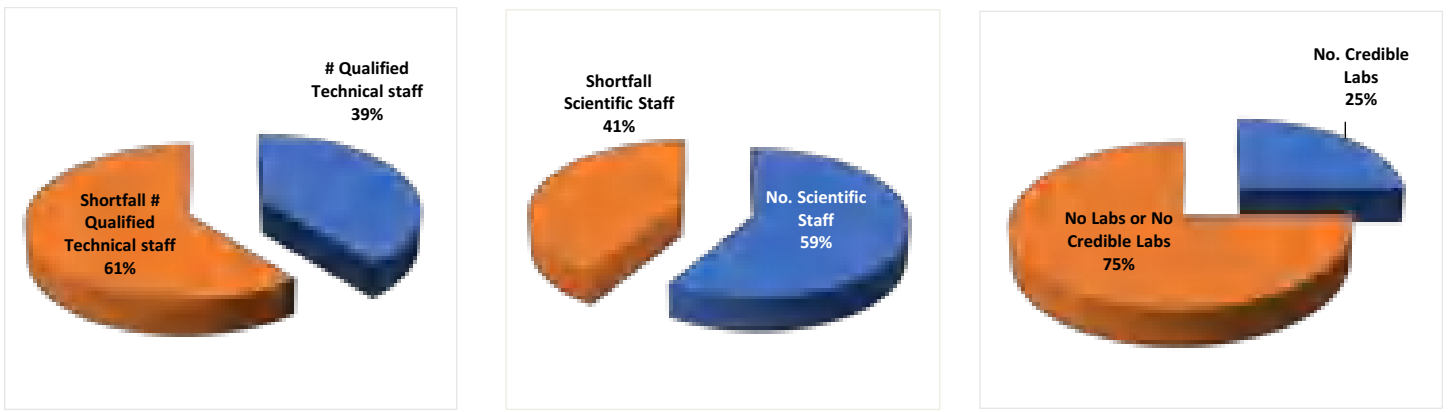


Figure 11 - Graphic illustration of the number and %: a) qualified engineering/technical staff; b) professional scientists; c) access to credible laboratory services that complies with Green Drop standards

Ratio analysis has been done to determine the number of qualified technical and scientific staff assigned per WWTW. It is expected, but never tested before, that a higher ratio would correspond with well-performing and maintained wastewater systems, as represented by the GD score.

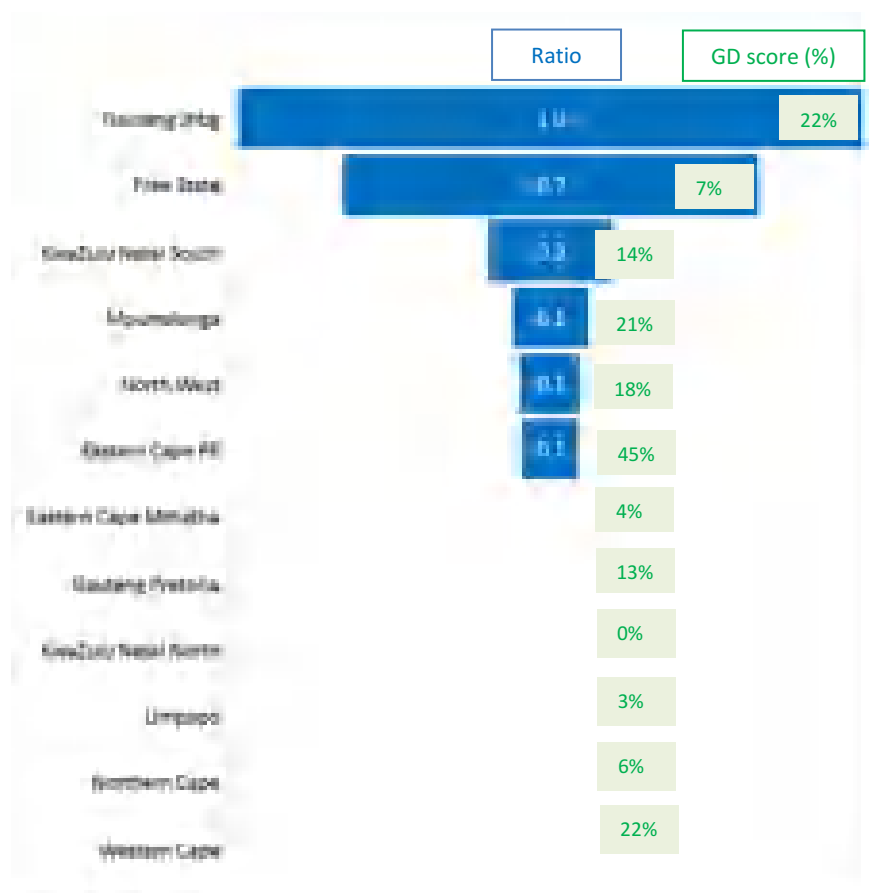


Figure 12 - Ratio of compliant technical staff to no. of WWTWs and Comparison of Ratios with GD scores

Figure 12 shows a close correlation for some of the DPW Regions with high ratios and high GD scores in the top half of Figure 12, with the anomaly being the Free State Region. Likewise, a correlation is observed between lower ratios and lower Green Drop scores in the bottom half of Figure 12, with the anomaly being the Western Cape Region. These results suggest that wastewater performance may be less sensitive towards engineering, technical and scientific staff, and more dependent on operational competencies (Superintendents and Process Controllers).

One manner of enhancing operational capacity is via dedicated training programmes. The Green Drop audit incentivise appropriate training of operational staff over a 2-year period prior to the audit date. The results are summarised as follows:

Table 12 - No. of WWTWs with operational staff sent on training over the past 2 years and vice versa

DPW Region	# WWTW staff attending training over past 2 years	# of WWTW without training over past 2 years
Eastern Cape Mthatha	0	16
Eastern Cape Port Elizabeth	11	0
Free State	0	6
Gauteng Pretoria	8	0
Gauteng Johannesburg	1	0
KwaZulu Natal North	0	13
KwaZulu Natal South	2	3
Limpopo	0	20
Mpumalanga	0	8
North West	0	10
Northern Cape	0	6
Western Cape	0	11
Totals	22 (19%)	93 (81%)

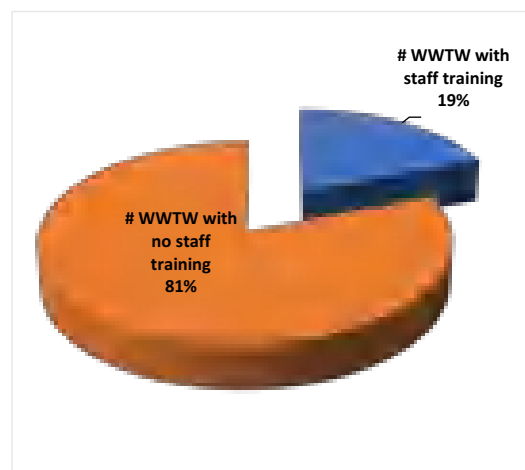


Figure 13 - %WWTWs that have trained operational staff over the past two years

The results confirmed that only 19% of WWTWs staff have had operational staff attend training over the past 2 years. This leaves a considerable gap in knowledge and skill and would require a concerted effort to strengthen the training initiatives of Supervisors and Process Controllers. Recent training events focussed primarily on chlorine handling and NQF, and need to be expanded to operation of technology, mathematic equations, sludge treatment and energy efficiency.

Diagnostic 3: Treatment Capacity

Aim: A capable treatment plant requires adequate design capacity and functional equipment to deliver a quality final water. If the plant capacity is exceeded by way of inflow volume or strength, a plant will not be capable to achieve its compliance standards. Capacity is typically exceeded when the demand exceeds the installed design capacity, or when processes or equipment is not operational or dysfunctional, or when the electrical supply cannot support the treatment infrastructure. This diagnostic assesses the status of plant capacity and operational flows to the plants.

Findings: Analysis of the hydraulic capacities and operational flows indicate a total design capacity of 39 MI/d for the DPW Regions, with a total inflow of 18 MI/day - considering that 70 systems are not measuring their inflows. Theoretically, this implies that 46% of the design capacity is used with 54% available to meet additional demand. However, the full 39 MI/d day is not available as some infrastructure is dysfunctional, leaving 33.1 MI/d available. The reduced capacity means that the DPW Regions are closer to its total available capacity than the data suggests. The consequence of insufficient capacity is that new housing and industrial developments would be impeded, which would counter local socio-economic initiatives. *It must be noted that many DPW Regions do not report or have knowledge of reduced capacity, and a higher figure can be expected.*

For the DPW Regions in general, most plants are operating within their design capacities, with the exception of some systems in the EC Mthatha, Free State, KZN South, Mpumalanga and Western Cape Regions. None of the DPW Regions reported a low % use of their overall capacity (<50%). Treatment systems with low % use may be affected by breakdown in sewer networks or pump stations whereby all sewage is not reaching the treatment works. The Green Drop audit requires a wastewater flow balance to identify and quantify possible losses from the network and/or ingress into the sewers. The DPW Regions do not have flow balances that follows the wastewater trail from consumer to treatment plant.

Table 13 - Summary of WWTWs design and available capacities, inflows, % use design capacities, and inflows measured per WWTW

DPW Region	# WWTWs	Design Capacity (MI/d)	Available Capacity (MI/d)	Operational Flow (MI/d)	Variance (MI/d)	% Use Design Capacity	Inflow measured #
Eastern Cape Mthatha	16	0.6	0.6	0.3	0.3	52%	10
Eastern Cape Port Elizabeth	11	4.5	4.4	3.5	1.0	78%	11
Free State	6	2.6	2.6	2.4	0.2	93%	6
Gauteng Pretoria	8	8.7	7.2	0.0	8.7	0%	NI
Gauteng Johannesburg	1	0.2	0.2	0.2	0.0	85%	1
KwaZulu Natal North	13	3.9	0.8	0.0	3.9	0%	NI
KwaZulu Natal South	5	0.8	0.6	0.0	0.8	0%	NI
Limpopo	20	0.4	0.4	0.0	0.4	0%	NI
Mpumalanga	8	2.3	2.3	1.5	0.8	65%	3

DPW Region	# WWTWs	Design Capacity (MI/d)	Available Capacity (MI/d)	Operational Flow (MI/d)	Variance (MI/d)	% Use Design Capacity	Inflow measured #
North West	10	2.9	2.9	0.1	2.9	2%	1
Northern Cape	6	1.9	1.0	1.7	0.3	87%	6
Western Cape	11	10.3	10.3	8.4	1.9	82%	7
Totals	115	39	33.1	18	21	46%	45

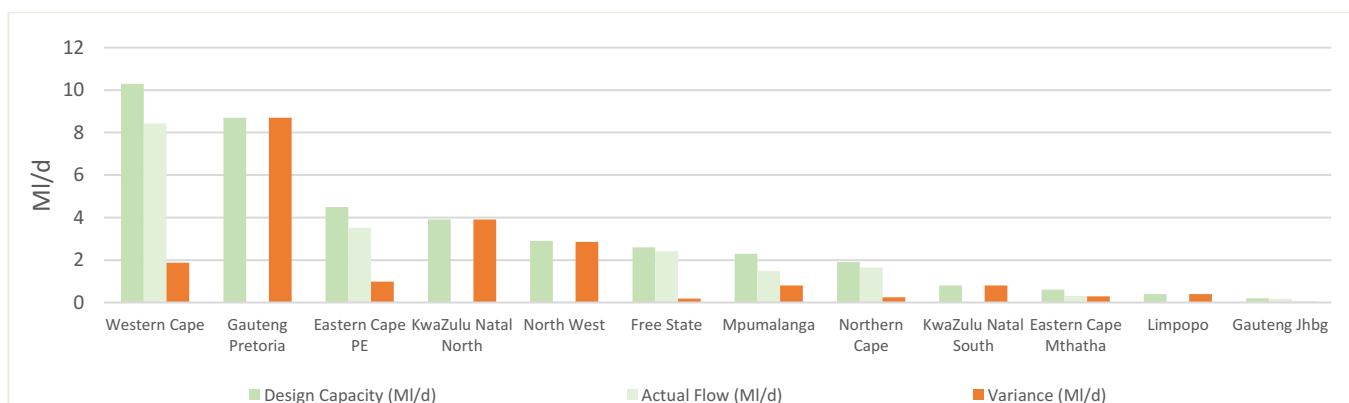


Figure 14 - Design capacity, actual flow, and variance in MI/d for WWTWs

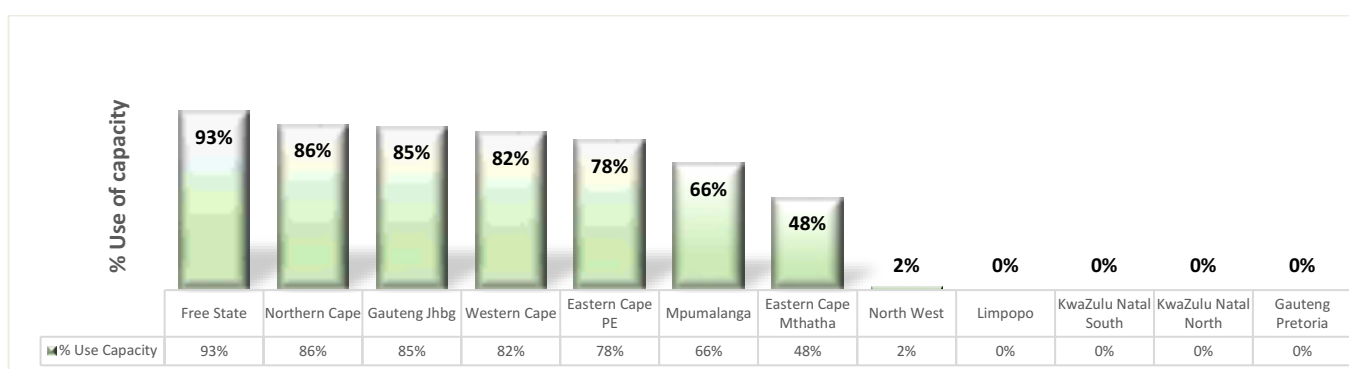


Figure 15 - % use of installed design capacity

The audit data shows that 8 systems with known design capacities are hydraulically overloaded. This figure will be higher as there are 70 systems that are not measuring their inflows and hence it is not possible to determine whether these systems are hydraulically overloaded as well. New housing and industrial developments in these drainage areas would not be able to proceed, without expansion of the capacity. The systems with known design capacities, that are hydraulically overloaded, are as follows:

- EC Mthatha: 1 of 16 systems (Willowvale DCS)
- Free State: 1 of 6 systems (Goedemoed Correctional Centre)
- KZN South: 1 of 5 systems (New Hanover prison)
- Mpumalanga: 1 of 8 systems (Lebombo PoE)
- Western Cape: 4 of 11 systems (Voorberg, Brandvlei, Dwarsrivier and Drakenstein Prisons).

Lastly, Water Use Authorisations mandate the DPW Regions to install and monitor flow meters, whilst GD requires the DPW Regions to report inflows on IRIS and to calibrate meters annually.

The audit results indicate that 39% (45 of 115) of DPW Regions monitor their inflow, with the balance of 61% (70 of 115) not monitoring their inflow (WWTWs linked to all the Regions apart from Eastern Cape PE, Free State, Gauteng Johannesburg, and Northern Cape). The majority of the DPW Regions do not calibrate or verify their flow meters on an annual basis, thereby failing to meet good practice standards.

Diagnostic 4: Wastewater Monitoring and Compliance

Aim "To measure is to know" and "To know is to manage". The primary objective of a wastewater treatment plant is to produce final effluent and biosolids to a safe standard. This standard cannot be measured or managed if operational- and compliance monitoring is lacking. This diagnostic assesses the monitoring status and final effluent compliance against each WWTW's mandatory standards.

Findings: For operational monitoring, a satisfactory level of 90% is applied as the benchmark, to give weight to the importance of monitoring. For compliance monitoring, the audit evaluates the sampling point, sampling frequency, final effluent quality, biomonitoring, heavy metals, and any specific condition that the DWS may have included in the water use licence. Final effluent quality compliance is calculated against the mandatory limits as listed under “Authorisation Status”. A >90% compliance figure confirms high quality final effluent, whereas a <30% indicate poor effluent quality. The enforcement measures are summarised in the column to the far right and include NWA Notices and Directives issued, criminal cases opened, and court interdicts granted during the period 1 April 2019 to 30 June 2021.

Table 14 - Summary of the operational and compliance monitoring status

DPW Region	# WWTW	Operational monitoring (KPA B2)		Compliance monitoring (KPA B3)	
		Satisfactory [GD score ≥90%]	Not Satisfactory [GD score <90%]	Satisfactory [GD score ≥90%]	Not Satisfactory [GD score <90%]
Eastern Cape Mthatha	16	0	16	0	16
Eastern Cape Port Elizabeth	11	0	11	0	11
Free State	6	0	6	0	6
Gauteng Pretoria	8	0	8	0	8
Gauteng Johannesburg	1	0	1	0	1
KwaZulu Natal North	13	0	13	0	13
KwaZulu Natal South	5	0	5	0	5
Limpopo	20	0	20	0	20
Mpumalanga	8	0	8	2	6
North West	10	0	10	0	10
Northern Cape	6	0	6	0	6
Western Cape	11	0	11	0	11
Totals	115	0 (0%)	115 (100%)	2 (2%)	113 (98%)

The performance recorded in Table 14 stems from performance data as measured against the Green Drop Standard expressed in KPAs B2 and B3. The data shows an overall unsatisfactory monitoring regime for both operational (0% satisfaction) and compliance (2% satisfaction) sampling and analysis. The DPW Regions are not meeting the Green Drop standard and need to prioritise this aspect on a national basis.

This is a concerning observation. Compliance monitoring is a legal requirement and the only means to measure performance of a treatment facility. Operational monitoring is the cornerstone of day-to-day process adjustments and optimisation to ensure treatment is efficient and deliver quality effluent/sludge that meet design expectations. Sludge monitoring is also essential as poor sludge handling is the root cause of many WWTWs failing to meet final effluent standards. The results indicate that the DPW Regions on average, is not achieving regulatory- and industry standards.

The following table summarises the results of KPA E, which also carries the highest Green Drop scoring weight. Note that all averages shown as ‘0%’ under Effluent Compliance, include actual 0% compliance plus systems with no information or insufficient data.

Table 15 - Summary of authorisation status, effluent compliance status, and directives/notices issued

DPW Region	Authorisation Status	Effluent Compliance									Enforcement Measures*
		Microbiological Compliance (%)			Chemical Compliance (%)			Physical Compliance (%)			
		Ave. (%)	# WWTWs >90%	# WWTWs <30%	Ave. (%)	# WWTWs >90%	# WWTWs <30%	Ave. (%)	# WWTWs >90%	# WWTWs <30%	
Eastern Cape Mthatha	6 GA; 10 Not authorised	0%	0	16	0%	0	16	0%	0	16	0
Eastern Cape Port Elizabeth	11 GA	72%	3	1	23%	0	5	56%	2	1	0
Free State	2 GA; 4 Not authorised	0%	0	6	0%	0	6	0%	0	6	0
Gauteng Pretoria	1 WUL; 7 Not authorised	0%	0	8	31%	0	4	34%	0	3	0
Gauteng Johannesburg	1 GA	0%	0	1	0%	0	1	0%	0	1	0
KwaZulu Natal North	13 Unknown	0%	0	13	0%	0	13	0%	0	13	0

DPW Region	Effluent Compliance										Enforcement Measures*
	Authorisation Status	Microbiological Compliance (%)			Chemical Compliance (%)			Physical Compliance (%)			
		Ave. (%)	# WWTWs >90%	# WWTWs <30%	Ave. (%)	# WWTWs >90%	# WWTWs <30%	Ave. (%)	# WWTWs >90%	# WWTWs <30%	
KwaZulu Natal South	1 Exempted; 4 Not authorised	0%	0	5	0%	0	5	0%	0	5	0
Limpopo	20 Unknown	0%	0	20	0%	0	20	0%	0	20	0
Mpumalanga	5 GA; 3 Not authorised	18%	1	6	50%	4	4	25%	2	6	0
North West	1 WUL; 7 GA; 2 Not authorised	0%	0	10	0%	0	10	0%	0	10	2
Northern Cape	1 GA; 5 Unknown	0%	0	6	0%	0	6	0%	0	6	0
Western Cape	3 WUL; 8 GA	84%	5	1	73%	2	2	69%	4	1	0
Totals		14%	9	93	15%	6	92	15%	8	88	2

* The enforcement measures (notices or directives issued) are taken over a two-year financial period from July 2019 to June 2021

On average, the DPW Regions did not fare well in terms of final effluent quality compliance, with 14% compliance with microbial effluent quality, 15% with chemical-, and 15% with physical effluent quality. For the microbiological compliance category, 9 of 115 systems achieved >90% and 93 of 115 systems fell below 30%. For the chemical compliance category, 6 of 115 systems achieved >90% and 92 of 115 systems fell below 30%. For the physical compliance category, 8 of 115 systems achieved >90% and 88 of 115 systems fell below 30%.

A total of 2 Notices have been issued to the North West Region. These enforcement measures initiated by the Regulator would require leadership intervention and correction.

In terms of sludge compliance status, it is found that:

- 4 of the 115 plants (3%) classify their biosolids according to the WRC Sludge Guidelines in the Western Cape Region
- No plants monitor sludge streams
- 25 of 115 plants (22%) have 2017 Sludge Management Plans in place that are not being implemented
- 10 of 115 plants (9%) use sludge for agricultural purposes, landfill, commercial products, and thermal sludge practice.

In closing of this diagnostic, the data confirmed that only 3 of the DPW Regions have access to credible laboratories for compliance and operational analysis. These in-house or contracted laboratories have been verified to be accredited and/or have Proficiency Testing Schemes with suitable analytical methods and quality assurance. The DPW Regions are not meeting the regulatory expectation that all Regions have access to analytical services for compliance, operational and sludge monitoring.

Diagnostic 5: Energy Efficiency

Aim: The wastewater industry offers many opportunities to respond to climate change challenges by improving energy efficiency, reduce greenhouse gasses, and generate energy. The energy cost of sophisticated treatment technologies are in the order of 25-40% of the O&M budget (cited WRC 2021). This diagnostic investigates the status of energy efficiency management at a national and regional level with an aim to motivate for improved operational wastewater treatment efficiency.

Findings: The audit results suggest an overall low awareness of energy management in the DPW Regions. None of the DPW Regions conducted baseline energy audits or could report on electricity cost as R/kWh. No energy efficiency initiatives are in place. No system SPCs are calculated as part of good practice. No DPW Region could account for CO₂ equivalents associated with energy efficiency.

The information suggests that the DPW Regions have not established a specific report to monitor energy as part of the wastewater business. Energy efficiency management is not embedded in the DPW Regions, and potential cost savings and environmental gains are forfeited.

Key findings of the diagnostic include:

- 0% of DPW Regions have energy audits
- 0% of DPW Regions have energy management plans
- 0% of DPW Regions have energy efficiency initiatives
- 0% of DPW Regions have energy efficiency reports

Table 1: Energy consumption per unit of wastewater treated

DPW Region	Electricity (kWh/m ³)	Gas (kWh/m ³)	Total (kWh/m ³)	CO ₂ (kg/m ³)	CH ₄ (kg/m ³)
Western Cape	0.45	0.00	0.45	0.17	0.00
Other DPW Regions	0.00	0.00	0.00	0.00	0.00

Key findings of the diagnostic include:

- 0% of DPW Regions have energy audits
- 0% of DPW Regions have energy management plans
- 0% of DPW Regions have energy efficiency initiatives
- 0% of DPW Regions have energy efficiency reports

Source: WRC, 2021. WRC Annual Report 2021

Diagnostic 6: Technical Site Assessments

Aim: The Green Drop process makes provision for the desktop audit being followed by a Technical Site Assessment (TSA) to verify the desktop evidence. The assessment includes physical inspection of the sewer network, pump stations, and treatment facility, coupled with asset condition checks to determine an approximate cost to restore existing infrastructure to functional status (VROOM).

Findings: The results of the DPW Region TSAs are summarised in Table 16. A deviation of >10% between the GD and TSA score indicate a misalignment between the administrative aspects and the work on the ground. The Regulator regards a wastewater system with a TSA score of >80% as one that have an acceptable level of process control and functional equipment. 90% would represent an excellent plant that complies with most of the Green Drop TSA standards.

Table 16 - Summary of the WWTW Technical Site Assessments scores and hardware problems and %deviation between GD and TSA scores

DPW Region	TSA WWTW Name	WWTW GD Score (%)	% TSA	Key Hardware Problems	Difference between TSA & GD score
Gauteng Jhbg	Devon	22%	66%	1. Improvement needed mostly on the operation of the plant; 2. In particular monitoring of process units, flow monitoring, sludge withdrawal from settlers, anaerobic digesters, sand replacement in the drying beds	44%
Mpumalanga	Barberton CS	25%	47%	1. Primary settling tanks; 2. Biofilters; 3. Anaerobic digesters; 4. Sludge sump pump 5. Electrical infrastructure	22%
Free State	Maseru Bridge	9%	57%	1. Mechanical equipment - one mixer, clarifier, and RAS pumps offline; 2. RAS pumps offline for 1.5 years - no sludge recycling; 4. Installation of flow meter – prone to short circuiting during wet weather conditions	48%
Eastern Cape Mthatha	Mthatha DCS	4%	13%	1. Blocked inlet; 2. Ponds lining; 3. Pump electric cables; 4. Irrigating leaf crops with effluent that is not monitored	9%
Eastern Cape PE	St Albans Prison	42%	81%	1. Ageing infrastructure - mechanical and structural	39%
Limpopo	Beit Bridge POE	3%	58%	1. Flow meter to be calibrated; 2. Spare aerator motor to be repaired	55%
Gauteng Pretoria	Thaba Tshwane	15%	33%	1. Disinfection; 2. Hydraulic overloading, 3. Distribution box overflow; 4. Sludge and Effluent Pumps	18%
North West	Losperfontein CS	22%	29%	1. Pumpstation pumps and mechanics; 2. General maintenance and repairs; 3. PST not functional, 4. Digester not functional; 5. Disinfection	7%
KwaZulu Natal North	Ncome Prison	0%	29%	1. Contractual challenges in terms of operations and maintenance; 2. Most mechanical equipment is under strain and require immediate maintenance and repair; 3. Biofilter effluent distribution arms; 4. Damaged bridges and walkways on settlers; 5. Operation and monitoring lacking	29%
	Waterval Prison	0%	59%	NI	59%
KwaZulu Natal South	Sevontein Prison	16%	42%	1. Pump station mechanical screen and standby pump; 2. Inflow and outflow meters; 3. Aerator no. 1 in the Pasveer ditch; 4. 1 no. RAS pump, 1 no. irrigation pumps, sludge return pump, balancing tank pump, and WAS pumps including some leaking and dysfunctional valves; 5. Unresolved electrical issue with tripping of the outflow meter, and the blown electrics in the panel box that serves the irrigation pumps	28%
Western Cape	Drakenstein Prison	22%	49%	1. Sludge dry beds; 2. Sludge lagoons, 3. Grit removal; 4. Flow metering	27%
Northern Cape	Lohattha MB	5%	26%	1. Primary Dortmund tanks need to desludge and re-commissioned; 2. Primary sludge transfer pumping station electro-mechanical equipment to be reinstated; 3. Biofilter unit processes to be re-commissioned; 4. Humus tanks to be re-commissioned; 5. Rapid gravity filters and Chlorine disinfection need to be re-instated	21%
Totals	13				9% to 55%

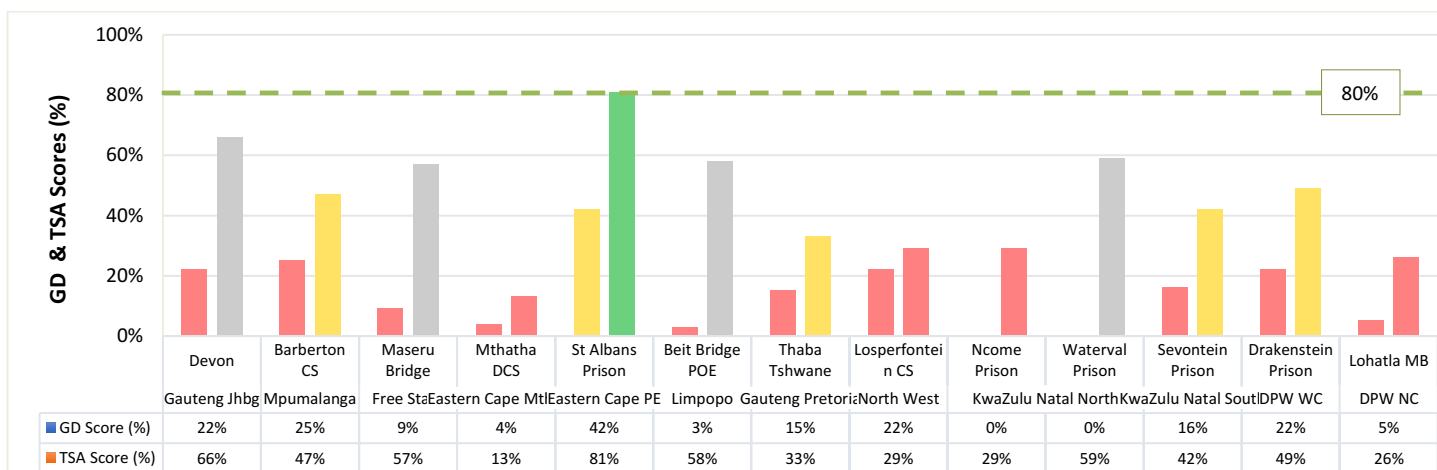


Figure 16 - GD score 2021 (bar left) and TSA score 2021 (bar right) comparison (colour legends as for GD – blue excellent; red critical)

A total of 13 site assessments were conducted, with 1 inspection per Region. Only one treatment works in Eastern Cape PE (81%) scored above 80%, which is generally regarded to be a satisfactory TSA score. Poor TSA scores indicate that treatment facilities fail to meet operational, asset functionality, and workplace safety standards.

An acceptably low difference between GD and TSA scores were observed for the Eastern Cape Mthatha (9%) and North West (7%) Regions. A low deviation implies that the wastewater management aspects correlate with the condition of processes and infrastructure in the field. Some focal points include:

- The Eastern Cape PE Region impressed with a very high TSA score of 81%, however, the GD score was low at 42%
- The Eastern Cape Mthatha and North West Regions had close matches to the GD scores of 9% and 7% respectively
- All the remaining DPW Regions had large deviations ranging from 21% to 59%, which emphasize that management, operation and functionality of the sewer network and treatment processes are well below standard.

The VROOM cost presents a “very rough order of measurement” cost to return a WWTWs functionality to its original design. For The Region, a total budget of R174 million is estimated, with the bulk of the work going towards restoration of mechanical equipment (62%).

Table 17 - VROOM cost split for civil, mechanical, and electrical and total VROOM cost estimate

DPW Region	Civil cost estimate	Mechanical cost estimate	Electrical & C&I cost estimate	Total VROOM cost
Gauteng Jhbg	R37,324	R79,608	R7,068	R124,000
Mpumalanga	R723,152	R6,392,305	R1,812,343	R8,927,800
Free State	R38,656	R19,270,235	R19,328	R19,328,220
Eastern Cape Mthatha	R58,806	R0	R38,394	R97,200
Eastern Cape PE	R1,432,593	R2,312,670	R201,273	R3,946,536
Limpopo	R55,930	R602,070	R0	R658,000
Gauteng Pretoria	R3,807,096	R13,298,760	R8,970,144	R26,076,000
North West	R22,370,310	R50,623,183	R9,859,507	R82,853,000
KwaZulu Natal North	R5,565,722	R8,008,857	R881,842	R14,456,420
KwaZulu Natal South	R449,187	R776,540	R4,923	R1,230,650
Western Cape	R4,018,545	R6,886,683	R4,853,772	R15,759,000
Northern Cape	R97,952	R349,112	R55,255	R502,320
Totals	R38,655,273	R108,600,023	R26,703,849	R173,959,146
% Distribution	22%	62%	16%	100%

The key hardware problems are listed in Table 16, with predominant defects in aging civil infrastructure and electrical infrastructure and components, primary and secondary clarification, recycle and return flows, sludge handling, sludge and effluent pumps, and power backup. Mechanical defects, maintenance and repairs typically include dysfunctional aerators, pumps, mixers, screens, degritters, and disinfection equipment. Contractual oversight and challenges in O&M, monitoring, vandalism and theft, long procurement lead times, lack of management involvement, lack of maintenance, lack of budget, and sparse laboratory (scientific) support are the main reasons for dysfunctional assets.

Diagnostic 7: Operation, Maintenance and Refurbishment of Assets

Aim: Inadequate financial resources are often cited as a root cause to dysfunctional or non-compliant wastewater systems. Knowledge and monitoring of fiscal spending are therefore a critical part of wastewater management. This diagnostic investigates the status of financial information as pertaining to O&M budgets and expenditure, asset figures, and capital funding.

Findings: A substantial amount of financial information was presented during the audit process. Unfortunately, the evidence was presented in different formats, levels of detail, or absent for some DPW Regions. It was observed that WSA teams with financial officials present during the audits typically performed better, and also had a good understanding of the wastewater challenges experienced by their technical peers. Discrepancies observed included: generic or non-ringfenced budgets, contract lump sums for Service Providers presented as budgets, outdated or incomplete asset registers, some cost drivers are lacking (mostly electricity), etc. The Regulator grouped data into different certainty levels, as can be summarised at the end of this Diagnostic.

It must be noted that there were limitations with the financial and asset information. Most of the DPW Regions did not submit current information or complete financial data sets.

The result of each financial portfolio is discussed hereunder.

Vroom Cost Analysis

The VROOM costs breakdown is discussed under the TSA Diagnostic but is further illustrated as follows.

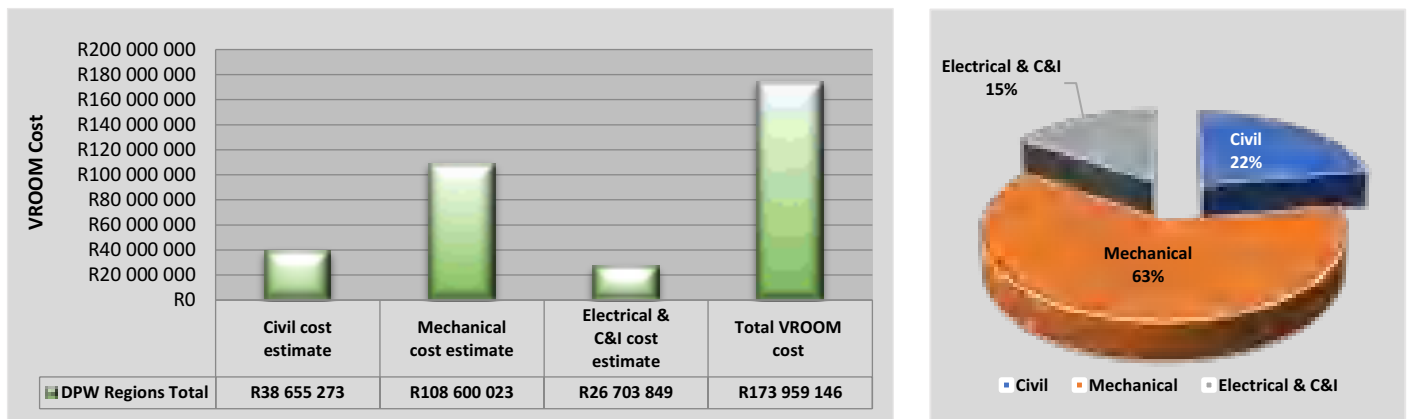


Figure 17 - Graphic illustration of the total cost estimated to restore functionality to existing assets (a), broken down to civil, mechanical, and electrical components

The total cost of R174 million is estimated to restore existing treatment works to their design capacity and functionality - made up by R109 million for mechanical repairs, R27 million for electrical repairs, and R39 million for civil structures.

Table 18 shows that a capital budget of R83 million has been secured over 1-3 years to address infrastructural needs, which does not adequately cover the R174 million VROOM refurbishment need and by implication, does not allow any surplus for other capital projects. The R174 million estimated VROOM cost constitutes 57.5% of the total asset value of R302.6 million. Furthermore, the WATCOST-SALGA figures provides for an annual 2.14% of the asset value required to maintain these assets. This constitutes an amount of R6.5 million required by the various WSA's annually to maintain the assets, while a once-off R174 million is required to restore existing assets.

Capital, O&M Budget and Actual, and Asset Value

The capital budgets, O&M budgets, O&M actual expenditure, and current asset values are summarised below.

Table 18 - Summary of the capital budgets, O&M budgets, O&M actual expenditure, and current asset values

DPW Region	Capital budget available	O&M budget (2020/21)	O&M expended (2020/21)	% Expended	Total Current Asset Value
Gauteng Jhbg	NI	NI	NI	NI	R11,800,000
Mpumalanga	R516,000	R2,658,000	R2,913,000	110%	R53,498,000
Free State	NI	R3,930,750	NI	NI	R37,956,800
Eastern Cape Mthatha	NI	NI	NI	NI	NI
Eastern Cape PE	R14,141,428	R5,736,960	R26,460,200	461%	NI

DPW Region	Capital budget available	O&M budget (2020/21)	O&M expended (2020/21)	% Expended	Total Current Asset Value
Limpopo	NI	NI	NI	NI	NI
Gauteng Pretoria	R68,420,790	NI	NI	NI	R27,616,000
North West	NI	NI	NI	NI	R67,183,520
KwaZulu Natal North	NI	NI	NI	NI	NI
KwaZulu Natal South	NI	NI	NI	NI	R57,645,100
Western Cape	NI	NI	NI	NI	NI
Northern Cape	NI	NI	NI	NI	R46,932,500
Totals	R83,078,218	R12,325,710	R29,373,200	238%	R302,631,920

The Green Drop process provides a bonus (incentive) in cases where Water Services Institutions provide evidence of capital projects with secured funding since this is deemed as a definitive means of addressing wastewater services inadequacies. This incentive encourages wastewater infrastructure investment. A total capital budget of R83 million has been reported for the refurbishment and upgrades of wastewater infrastructure for the DPW Regions over a 1-to-3-year fiscal period. The largest capital budget is observed for the Gauteng Pretoria Region (R68m).

For the 2020/21 fiscal year, the total O&M budget reported for the DPW Regions was R12.3 million, of which R29.4 million (238%) has been expended. Over-expenditure of 461% by the Eastern Cape Region and 110% for the Mpumalanga Region was observed. The provincial figures exclude 10 of the 12 DPW Regions who did not have financial or who had partial information.

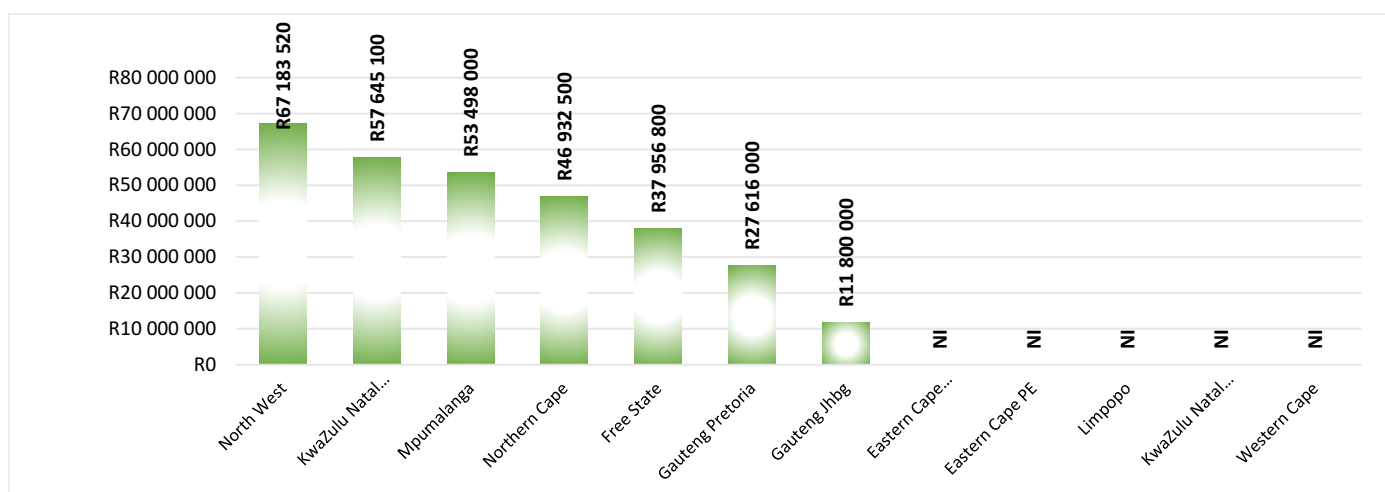


Figure 18 - Total current asset value reported by the DPW Regions

The total current asset value for wastewater infrastructure (networks, pumpstations, treatment plants) is reportedly R303 million (excluding 5 DPW Regions with no information). The highest asset values are observed for the Regions North West (R67m), followed by KwaZulu Natal South (R58m) and Mpumalanga (R53m).

O&M Cost Benchmarking

By combining the SALGA and WRC WATCOST models, an estimation of the maintenance cost required per asset type can be done, i.e. civil, buildings, pipelines, mechanical, electrical, and instrumentation. The maintenance benchmark departs from the basis that 15.75% of the asset value is required to maintain these assets.

Table 19 - SALGA-WRC annual maintenance budget guideline and cost estimation

Description	% of Current Asset Value	Asset Value Estimate	Modified SALGA Maintenance Guideline	Annual Maintenance Budget Guideline
Current Asset Value estimate	100%	R302,631,920	15.75%	R6,476,323
<i>Broken down into:</i>				
1. Civil Structures	46%	R139,210,683	0.50%	R696,053
2. Buildings	3%	R9,078,958	1.50%	R136,184
3. Pipelines	6%	R18,157,915	0.75%	R136,184
4. Mechanical Equipment	35%	R105,921,172	4.00%	R4,236,847

Description	% of Current Asset Value	Asset Value Estimate	Modified SALGA Maintenance Guideline	Annual Maintenance Budget Guideline
5. Electrical Equipment	8%	R24,210,554	4.00%	R968,422
6. Instrumentation	2%	R6,052,638	5.00%	R302,632
Totals	100%	R302,631,920	15.75%	R6,476,323
Minus 20% P&Gs and 10% Installation				R1,942,897
Total				R4,533,426

The model estimates that R6.5 million (2.14%) is required per year to maintain the assets valued at R303 million. Notably, this maintenance estimate assumes that all *assets are functional*. The VROOM cost represent the monies needed to get assets functional, from which basis route maintenance could then focus on maintaining the assets.

Table 20 indicates the SALGA maintenance cost estimation in relation to the VROOM cost, O&M budget, and O&M actual expended.

Table 20 - O&M cost estimates by the SALGA and VROOM models versus actual budget and expenditure figures

Cost Reference	O&M Cost Estimate	Period
Modified SALGA	R6,476,323	Annually, estimation
O&M Budget	R12,325,710	Actual for 2020/21
O&M Spend	R29,373,200	Actual for 2020/21
VROOM	R173,959,146	Once off estimation

The cost dynamics can be summarised as follows:

- The SALGA estimations for O&M budgets are close to 50% of the actual reported budgets for the 2020/21 fiscal year. This is influenced by asset values not provided for by 5 of the DPW Regions
- The actual O&M budget does not seem adequate when compared with the SALGA guideline. This is influenced by full O&M budgets and actuals not provided for by 10 of the DPW Regions
- The VROOM cost represents an estimation of the refurbishment cost to restore WWTWs functionality and design capacity.

Production Cost

It is good business practice to monitor and manage the production costs of wastewater treatment in Rand/m³ treated, and to compare such cost with industry norms. Published benchmarks is not currently available for typical treatment (production) costs, but significant cost increases are expected since 2013, given the variable input factors such as Covid, and cost of chemicals, transport, and electricity. From an economic perspective, it is valuable to compare production cost at time of budgeting versus actual production costs. However, due to scarce information, it is not possible to provide insight as to possible shortfalls from an economic perspective.

No production costs for wastewater treatment could be concluded, which leaves a significant gap in the financial portfolio of the DPW. Readers may view the results obtained for municipalities in Gauteng, KwaZulu Natal, Eastern Cape and Western Cape, to obtain a sense of typical production costs at South African wastewater treatment facilities.

The DPW Regions did not provide production costs for their respective systems. Production costs remain an invaluable parameter and carry economic value and benefit. Given the lack of data during the 2021 audit cycle, it would be imperative for Superintendents to determine and monitor production (treatment) cost as a parameter within the fiscal reporting framework going forward.

Data Certainty

Data certainty is expressed at different levels for the financial and asset figures reported within this Diagnostic. Certainty levels may differ from system to system, hence the repeat of some DPW Regions as the data provided for is variable or inconsistent or limited or non-existent (NI). DPW Regions that were identified under the category "High Certainty", presented consistent and verifiable evidence in the form of budgets, expenditure, asset registers, and unit costs.

Table 21 - Levels of certainty associated with financial and asset information reported by the DPW Regions

Data Certainty	Description	DPW Region
No certainty	Absent data or no certainty in data presented - not ringfenced for WWTW & Network	Eastern Cape Mthatha, Limpopo, KwaZulu Natal North, Western Cape
Low certainty	Minor or little certainty in the data - partially ringfenced for WWTW only or data as extreme outliers	Gauteng Johannesburg, Free State, Gauteng Pretoria, KwaZulu Natal South, Northern Cape, Eastern Cape PE, North West
Reasonable/good certainty	Reasonable to good level of certainty in the data - ringfenced for WWTW and/or Network and data falls within/close to expected parameters	Mpumalanga
High certainty	High level of certainty in the data - ringfenced for WWTW and Network and data falls within expected parameters	None

DISCLAIMER

The *'Regulator's Comment'* that follows is verbatim provided by the Lead Inspector that audited the wastewater system.

4.1 Eastern Cape (Mthatha) Region

Water Service Institution	DPW Mthatha Eastern Cape	
Water Service Provider	DPW Mthatha Eastern Cape	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	4% ↑	1. Blockages to inlet works
2013 Green Drop Score	2%	2. Maintenance defects
2009-11 Green Drop Score	NA	3. Electrical cables
		VROOM Estimate:
		- R97,200

Key Performance Area	Weight	Cofimvaba DCS	Centane complex	Elliotdale DCS	Elliotdale SAPS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	6.3%	6.3%	6.3%	0.0%
D. Technical Management	20%	31.2%	0.0%	26.5%	0.0%
E. Effluent & Sludge Compliance	30%	7.5%	7.5%	7.5%	18.8%
F. Bonus		5.0%	5.0%	5.0%	5.0%
G. Penalties		-25%	-25%	-25%	-75.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		7%	1%	6%	0%
2013 Green Drop Score		1%	NA	1%	1%
2009 - 2011 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.04	NI	NI	0.08
Design Capacity Utilisation (%)		25%	NI	NI	19%
Resource Discharged into		NI	NI	Xhorha River	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR % of CRR_{max})		Cofimvaba DCS	Centane complex	Elliotdale DCS	Elliotdale SAPS
CRR (2011)		NA	NA	NA	NA
CRR (2013)	%	82.4%	NA	100.0%	41.2%
CRR (2021)	%	82.4%	100.0%	100.0%	82.4%

Key Performance Area	Weight	Engcobo DCS	Flagstaff DCS	Lusikisiki DCS	Maluti Military Base
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	6.3%	6.3%	6.3%	6.3%
D. Technical Management	20%	16.5%	31.2%	26.5%	0.0%
E. Effluent & Sludge Compliance	30%	7.5%	7.5%	7.5%	7.5%
F. Bonus		5.0%	5.0%	5.0%	5.0%
G. Penalties		-25%	-25%	-25%	-25%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		4%	7%	6%	1%
2013 Green Drop Score		0%	1%	0%	0%
2009 - 2011 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.019	0.028	NI	NI
Design Capacity Utilisation (%)		79%	36%	NI	NI
Resource Discharged into		Open veld to river	Nearby stream	Nearby stream	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR % of CRR_{max})		Engcobo DCS	Flagstaff DCS	Lusikisiki DCS	Maluti

Key Performance Area	Weight	Engcobo DCS	Flagstaff DCS	Lusikisiki DCS	Maluti Military Base
					Military Base
CRR (2011)		NA	NA	NA	NA
CRR (2013)	%	76.5%	100.0%	70.6%	70.6%
CRR (2021)	%	88.2%	82.4%	100.0%	100.0%

Key Performance Area	Weight	Mthatha DCS (Wellington)	Mthatha 14 SAI MB	Mt Fletcher DCS	Mqanduli DCS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	6.3%	6.3%	6.3%	6.3%
D. Technical Management	20%	26.5%	31.2%	31.2%	31.2%
E. Effluent & Sludge Compliance	30%	7.5%	7.5%	7.5%	7.5%
F. Bonus		7.5%	5.0%	5.0%	5.0%
G. Penalties		-25.0%	-25%	-25%	-25%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		6%	7%	7%	7%
2013 Green Drop Score 2021		0%	0%	0%	2%
2009 - 2011 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	NI	0.28	0.07	0.043
Design Capacity Utilisation (%)		NI	59%	81%	35%
Resource Discharged into		Mthatha River	To the open veld then small stream	NI	Nearby stream
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR % of CRR _{max})		Mthatha DCS (Wellington)	Mthatha 14 SAI MB	Mt Fletcher DCS	Mqanduli DCS
CRR (2011)		NA	NA	NA	NA
CRR (2013)	%	100.0%	58.8%	82.4%	58.8%
CRR (2021)	%	100.0%	88.2%	88.2%	82.4%

Key Performance Area	Weight	Ngqamakwe DCS	Qunu Museum	Ntabankulu DCS	Willowvale DCS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	6.3%	0.0%	0.0%	0.0%
D. Technical Management	20%	31.2%	0.0%	4.7%	31.2%
E. Effluent & Sludge Compliance	30%	7.5%	7.5%	7.5%	7.5%
F. Bonus		5.0%	0.0%	0.0%	5.0%
G. Penalties		-25%	-25%	-25%	-25%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		7%	2%	1%	5%
2013 Green Drop Score		3%	0%	2%	1%
2009 - 2011 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.037	NI	0.038	0.013
Design Capacity Utilisation (%)		NI	NI	81%	NI
Resource Discharged into		Designed to irrigate	Nearby stream	Nearby stream	Nearby stream
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR % of CRR _{max})		Ngqamakwe DCS	Qunu Museum	Ntabankulu DCS	Willowvale DCS
CRR (2011)		NA	NA	NA	NA
CRR (2013)	%	82.4%	88.2%	76.5%	100.0%
CRR (2021)	%	82.4%	100.0%	82.4%	100.0%

Regulator's Comment:

The DPW Mthatha Regional team is commended for the effort they have put to engage and prepare for the Green Drop audit. The Regulator acknowledges that all the team members involved were new to the programme and in the sanitation services department. Regrettably, the lack of information dominated the audit, notably because operations and maintenance have always been conducted by an external service provider who is no longer in service. The new DPW team (less than a year with the department) had to start acquiring all the relevant information and familiarise themselves with the wastewater systems. However, the lesson learnt is that contractors will always change, but the DPW need to have the required systems in place to oversee work in the field, budgets, performance and compliance. The team is advised to collate all information from the DPW Director General's special Green and Blue Drop programme of 2017-2018, which included the development of asset registers, Process Audits, W₂RAPs, O&M manuals and costs, monitoring plans, PFDs, installation of flow meters, and many more. These documents will provide a solid foundation from where wastewater management can be build, and performance contractors can be developed to ensure all service providers are Green Drop compliant.

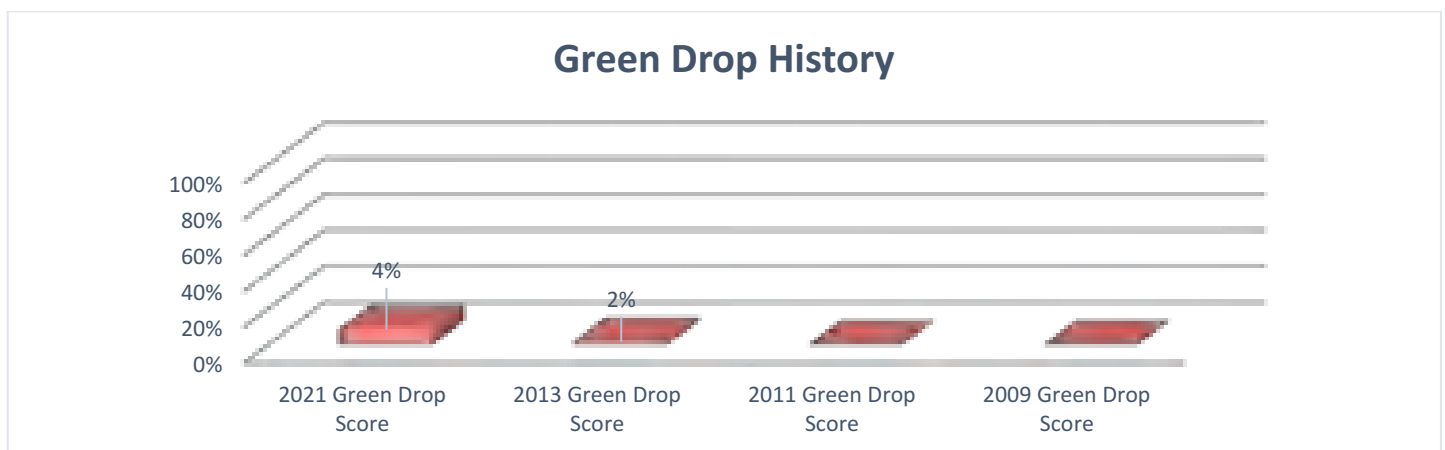
The Regulator is concerned about the lack of qualified Superintendents and Process Controllers at all wastewater systems in Mthatha, which is not only a legal risk, but also evident in the lack of operation on site (Mthatha and Willowvale DCS). The prison inmates are responsible for cleaning the inlets of the pond systems - which appears to occur infrequently and inappropriately. An example being the lack of disposal of screenings at Mthatha DCS which create a hazardous environment. KPA A deals with technical capacity, and the 0% score would indicate that no competent skills exist pertaining to engineers, technicians, operators, scientists, and maintenance staff. KPA B also received a 0%, signifying that work needs to be done in risk management, operational and compliance monitoring, sludge handling and laboratory services.

It would be remiss if the Regulator does not raise the very poor state of wastewater services and consequential impact on the water resources, as is evident from the 4% Green Drop score, and continuing from 2% in 2013.

Green Drop findings:

1. None of the 16 WWTWs have qualified or registered Supervisors or Process Controllers at the plants, therefore do not comply with Reg. 2834 and/or draft Reg. 813
2. Zero of the 16 plants are classified with DWS and have not valid authorisations in place
3. No engineer, technical or scientific competencies could be verified
4. No operational nor compliance monitoring could be presented
5. Financial information was absent, including budgets, expenditure and unit costs
6. None of the wastewater systems has flow meters in place
7. No effluent quality monitoring plan is in place and zero data could be presented to indicate the efficiency of the plants
8. Seven (7) of the 16 WWTWs are in critical risk positions and 9 in high risk CRR positions
9. No information related to capital projects for replacement, upgrades, and addition of new unit process at all the WWTWs and associated infrastructure to address the deficiencies identified in the GD Report Card.

The Regulator is concerned about the poor state of wastewater services and the consequential impact on the water resources and require the WSI to submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Mthatha DCS (Wellington prison) WWTW 17%

The Mthatha DCS (Wellington prison) WWTW was inspected to verify the Green Drop audit findings:

- There are no lengthy networks nor pumpstation associated with the plant. WWTWs is by gravity fed and the network comprises of the pipelines within the Correctional Service
- The treatment site is fenced but the workplace conditions are not conducive to a positive work environment
- Administrative records were absent, with no operational or compliance monitoring being done
- There was poor housekeeping at the plant, including handling of screenings and electric cables associated with the irrigation pump
- No flow meters are in place; therefore, no raw sewage quality or extraneous flows are monitored.



4.2 Eastern Cape (Port Elizabeth) Region

Water Service Institution	DPW Port Elizabeth Eastern Cape		
Water Service Provider	Zanamansi Water Solution		
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality): 1. Ageing infrastructure - mechanical and structural 2. Sewer network and treatment plant in very good condition. VROOM Estimate: - R3,946,536		
2021 Green Drop Score			45%↑
2013 Green Drop Score			8%
2009-11 Green Drop Score			NA

Key Performance Area	Weight	Middeldrift Prison Piggery	Healdtown Police Station	Debe Nek Police Station	Die Blaar Housing Complex
A. Capacity Management	15%	80.0%	74.0%	80.0%	80.0%
B. Environmental Management	15%	51.3%	41.0%	51.3%	52.5%
C. Financial Management	20%	11.9%	29.5%	11.9%	11.9%
D. Technical Management	20%	15.3%	19.0%	15.3%	35.3%
E. Effluent & Sludge Compliance	30%	43.8%	50.0%	37.5%	37.5%
F. Bonus		3.0%	3.0%	3.0%	3.0%
G. Penalties		3.0%	3.0%	3.0%	3.0%
H. Disqualifiers		-25.0%	-25.0%	-25.0%	-5.0%
Green Drop Score (2021)		40%	44%	38%	45%
2013 Green Drop Score		6%	8%	5%	6%
2009-11 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.066	0.017	0.0127	0.015
Design Capacity Utilisation (%)		91%	88%	100%	100%
Resource Discharged into		Irrigation	Kat River	Irrigation	Irrigation
Microbiological Compliance	%	69%	100%	77%	70%
Chemical Compliance	%	0%	0%	0%	41%
Physical Compliance	%	96%	42%	51%	53%
Wastewater Risk Rating (CRR% of CRR_{max})		Middeldrift Prison Piggery	Healdtown Police Station	Debe Nek Police Station	Die Blaar Housing Complex
CRR (2011)	%	82.4%	47.1%	88.2%	58.7%
CRR (2013)	%	100.0%	75.9%	70.6%	70.6%
CRR (2021)	%	58.8%	64.7%	70.6%	70.6%

Key Performance Area	Weight	Stormsriver Police Station	Kwaaibrandt Housing Complex	Patensie Prison	Kirkwood Prison
A. Capacity Management	15%	84.0%	84.0%	92.5%	96.0%
B. Environmental Management	15%	42.0%	42.0%	51.3%	41.0%
C. Financial Management	20%	29.5%	29.5%	11.9%	29.5%
D. Technical Management	20%	36.0%	30.0%	15.3%	25.0%
E. Effluent & Sludge Compliance	30%	50.0%	24.0%	37.5%	30.0%
F. Bonus		3.0%	3.0%	3.0%	3.0%
G. Penalties		-5.0%	0.0%	-5.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		52%	43%	43%	46%
2013 Green Drop Score		6%	5%	12%	14%
2009-2011 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.009	0.015	0.4	1.8
Design Capacity Utilisation (%)		100%	64%	100%	61%
Resource Discharged into		Storms River	Irrigation	Gamtoos River	Sunday

Key Performance Area	Weight	Stormsriver Police Station	Kwaaibrandt Housing Complex	Patensie Prison	Kirkwood Prison
Microbiological Compliance	%	100%	70%	70%	70%
Chemical Compliance	%	0%	41%	41%	41%
Physical Compliance	%	61%	53%	53%	53%
Wastewater Risk Rating (CRR% of CRR _{max})		Stormsriver Police Station	Kwaaibrandt Housing Complex	Patensie Prison	Kirkwood Prison
CRR (2011)	%	64.7%	47.1%	58.8%	58.8%
CRR (2013)	%	70.6%	70.6%	100.0%	100.0%
CRR (2021)	%	64.7%	70.6%	64.7%	64.7%

Key Performance Area	Weight	Middeldrift Prison	St Albans Prison	Bulembu SAPS Airport
A. Capacity Management	15%	96.0%	94.0%	80.0%
B. Environmental Management	15%	45.0%	43.5%	32.5%
C. Financial Management	20%	29.5%	29.5%	11.9%
D. Technical Management	20%	36.5%	25.0%	28.2%
E. Effluent & Sludge Compliance	30%	50.0%	9.0%	0.0%
F. Bonus		3.0%	15.0%	3.0%
G. Penalties		0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None
Green Drop Score (2021)		55%	41%	30%
2013 Green Drop Score		6%	5%	3%
2009- 2011 Green Drop Score		NA	NA	NA
System Design Capacity	ML/d	0.6	1.5	0.05
Design Capacity Utilisation (%)		83%	90%	70%
Resource Discharged into		Kieskama River	Swartkops	Irrigation
Microbiological Compliance	%	92%	70%	Insufficient data set
Chemical Compliance	%	50%	41%	Insufficient data set
Physical Compliance	%	100%	53%	Insufficient data set
Wastewater Risk Rating (CRR% of CRR _{max})		Middeldrift Prison	St Albans Prison	Bulembu SAPS Airport
CRR (2011)	%	29.4%	64.7%	NA
CRR (2013)	%	100.0%	100.0%	100.0%
CRR (2021)	%	35.3%	64.7%	76.5%

Regulator's Comment:

The DPW Port Elizabeth Region impressed with a remarkable upgrade in its overall Green Drop score of 45%, compared to the 8% baseline score in 2013. DPW was well represented by the regional staff and their technical services provider. For the 2023 audit, involvement of financial officials would have resulted in additional score, as the evidence for budget processing, budgets, expenditure, assets, and capital was lacking and attracted low scores for KPA C.

DPW PE and Zanamanzi performed very well with regards to capacity management with suitably qualified staff for operations and maintenance and the laboratory services. A qualified engineer and one scientist supported by three other scientists/analysts on a contractual basis, completed a high score on capacity. This expertise is evident as it translates to a very high technical site assessment score. Monitoring is taking place at all plants and regular analysis conducted through a contract with Integral Laboratory Services. There remain serious shortcomings with regards to sludge monitoring, as well as operational- and compliance monitoring, which is either absent or an incomplete set of constituents are monitoring.

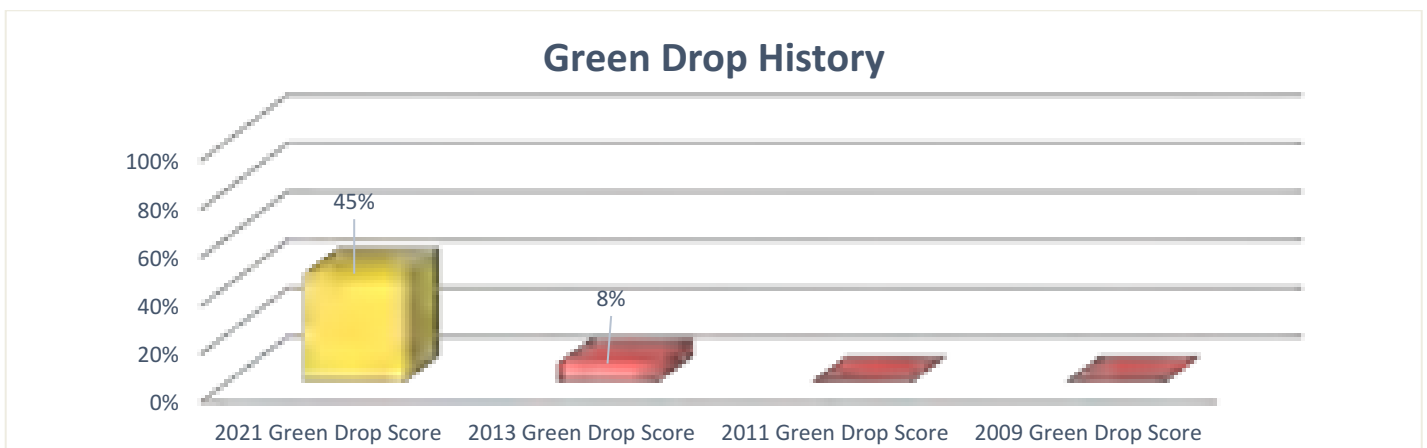
Adoption and implementation of a site-specific W₂RAP based on a comprehensive process audit of each plant will enable DPW PE to identify, prioritise and mitigate high risks in all collection systems. The adoption of the W₂RAP needs to be followed up by implementation of risks identified and records thereof kept such that the organisation can keep track of risk mitigation measure identified and whether they are successful or not. The finance department must ensure high risks are covered in the 2022/23 fiscal budget, to ensure that the root causes of non-compliance is addressed.

Many of the treatment facilities also moved from a CRR high and critical risk space into medium risk positions. Well done. The regulator encourages the DPW team to identify and rectify these risks as a matter of priority.

Site inspection highlighted the positive strides that are taken by the team in order to ensure the WWTW runs optimally. During the time of the site inspection a one humus tank and a biofilter were out of service and receiving attention from a contractor. A clear indication that the organisation is serious about their wastewater business, which bodes well for the PE region. The Regulator congratulates PE management, the regional champion, and the service provider for the progressive movement in the Green Drop and CRR risk space. It is advised that cross pollination takes place with other DPW regions in South Africa, to share and replicate good practice across DPW nationally.

Green Drop findings:

1. Satisfactory performance by most WWTW for process control staff and scientists, supported by a contracted maintenance team. Qualified Technicians and Technologists remains a gap
2. Qualified maintenance teams are contracted, who has schedules and logbooks in place for repair work
3. W₂RAPs were excellently compiled, but outdated and lacking implementation
4. Operational and compliance monitoring gaps were noted for all plants
5. Sludge monitoring and management requires attention
6. Zero of the eleven (11) systems could provide a comprehensive budget and expenditure report to determine the true cost of treatment in Rand per Kilolitre of wastewater treated, and cost drivers are unknown except for the Zanamanzi contracted amount over 2 years
7. Good asset registers are in place but not linked to maintenance plans or budgets
8. Since DPW has no competency or empowered to implement local government by-laws, only the available by-laws from WSAs in which they operate under were presented. In the future assessments prior engagements between the WSA and DPW needs to take place in order to prepare for this KPA
9. Lack of flow monitoring is a concerning and resulted in application of penalties for most plants. It is a basic (and legal) requirement to monitor inflow and outflow to determine whether the WWTW operates within its hydraulic design capacity. A further gap is noted whereby the actual organic load to the plant is not calculated and compared with the design load (COD)
10. Four of the eleven plants are in the high-risk positions
11. Capital projects have been scoped from Process Audit Reports, but no evidence of secured budgets presented:
 - R4,900,000: Middeltdrift Prison Piggery WWTW refurbishment
 - R4,550,000: Healdtown Police Station WWTW refurbishment (electrical component)
 - R311,000: Debe Nek Police Station WWTW refurbishment for electrical components and lining of ponds
 - R326,900: Die Blaar Housing Complex WWTW refurbishment for electrical components and lining of ponds
 - R906,428: Kwaaibrandt Housing Complex WWTW refurbishment for electrical components and lining of ponds
 - R906,428: Patensie Prison WWTW refurbishment for electrical components and lining of ponds
 - R3,413,716: Middlesdrift Prion WWTW refurbishment of electrical components
 - R2,700,000: Refurbishment of biofilters, inlet works, chlorination system.



Technical Site Assessment

St Albans Prison WWTW **81%**

The **St Albans Prison WWTW** was inspected to verify the Green Drop audit findings:

- The network and pumpstation was in good condition, there was routine maintenance, adequate response to sewage blockages
- The plant is well secured, sign posted and have security onsite
- The treatment plant infrastructure is old however still in good condition, with excellent staff facilities (kitchen, showers, change room, office), safety signs and lighting
- The plant is commended for the maintenance initiatives at the works, during the time of the inspection there was replacement of media in the biofilter
- Document management is outstanding, but evidence was provided of comprehensive O&M manuals complete with manufacturers specs, PFD, and record of all maintenance issues (job cards, works orders, tracking of outstanding jobs)
- Staff is knowledgeable and passionate about their plant, reporting their satisfaction with support they get from DPW and Zanamanzi
- The plant is equipped with mechanical front rake screens backed up by manually operated screens, 2 PSTs, Upward flow Dortmund with conical base, 3 biofilters stone filled with rotating arm, currently 2 are in operation one is out of commission due to filter media replacement, 2 upward-flow Dortmund humus tanks currently 1 is in operation, the two are currently undergoing mechanical refurbishment. Sludge treatment is by means 3 anaerobic digesters and 24 sludge drying beds. The plant is further equipped with an incinerator which uses light fuel/diesel
- Water after chlorination is transferred to 8 maturation ponds for final polishing
- Chlorination system has recently been refurbished and is in good working order. The chlorine room is well ventilated, with relevant safety signs and equipment
- The digesters are mainly used for sludge maturation at the plant
- Sludge drying beds are in good condition, clear of weed, under-drains functional – noting good quality dry biosolids, monitoring of critical statistics not observed
- No active performance management takes place, no monitoring takes place and no energy efficiency or energy generation (biogas) initiatives are undertaken.

		
<p><i>24x Sludge drying beds operational</i></p>	<p><i>Access control by security on-site</i></p>	<p><i>Humus tank not in operation</i></p>

4.3 Free State Region

Water Service Institution	DPW Free State		
Water Service Provider	DPW Free State		
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):		
2021 Green Drop Score	7%↓	1. Civil structure at Maseru Bridge PoE in good condition and well maintained	
2013 Green Drop Score	14%	2. Mechanical equipment needs attention - one mixer, clarifier, and RAS pumps offline	
2009-11 Green Drop Score	NA	3. RAS pumps offline for 1.5 years - no sludge recycling	
		4. Installation of flow meter – prone to short circuiting during wet weather conditions.	
		VROOM Estimate:	
		- R19,328,220	

Key Performance Area	Weight	22 Field Engineer Regiment Bethlehem	Caledonspoort Port of Entry	Goedemoed Correctional centre	Groenpunt Correctional Centre
A. Capacity Management	15%	20.0%	20.0%	32.0%	20.0%
B. Environmental Management	15%	35.0%	54.0%	0.0%	21.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	5.0%
D. Technical Management	20%	24.5%	24.5%	24.5%	24.5%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	-50.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		9%	12%	2%	8%
2013 Green Drop Score		18%	1%	8%	20%
2009-11 Green Drop Score		NA	NA	NA	NA
System Design Capacity	ML/d	0.1496	0.0353	0.6904	1.5016
Design Capacity Utilisation (%)		47%	37%	109%	97%
Resource Discharged into		Jordan River	Caledonspoort River	Orange River	Vaal River
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		22 Field Engineer Regiment Bethlehem	Caledonspoort Port of Entry	Goedemoed Correctional centre	Groenpunt Correctional Centre
CRR (2011)	%	NA	NA	NA	NA
CRR (2013)	%	64.7%	82.4%	76.5%	64.7%
CRR (2021)	%	82.4%	82.4%	88.2%	88.2%

Key Performance Area	Weight	Maseru Bridge	Van Rooyenshek Port of Entry
A. Capacity Management	15%	30.0%	25.0%
B. Environmental Management	15%	24.0%	0.0%
C. Financial Management	20%	0.0%	25.0%
D. Technical Management	20%	24.5%	28.8%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%
F. Bonus		0.0%	17.5%
G. Penalties		-25.0%	-25.0%
H. Disqualifiers		None	None
Green Drop Score (2021)		9%	13%
2013 Green Drop Score		18%	NA

Key Performance Area	Weight	Maseru Bridge	Van Rooyenshek Port of Entry
2009-11 Green Drop Score		NA	NA
System Design Capacity	MI/d	0.1291	0.113
Design Capacity Utilisation (%)		93%	9%
Resource Discharged into		Caledon River	Soak away system - discharge to groundwater
Microbiological Compliance	%	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Maseru Bridge	Van Rooyenshek Port of Entry
CRR (2011)	%	NA	NA
CRR (2013)	%	64.7%	NA
CRR (2021)	%	88.2%	76.5%

Regulator's Comment:

The various project management teams that represented the DPW Free State Region were unprepared for the audit and had limited knowledge of their systems, as is evident from a critically low Green Drop score of 7%. Considering that the staff was only appointed in July 2021, it is understandable that the team have not been adequately introduced or trained on the operation of their respective WWTWs. The overall GD score declined from 14% in 2013 to 5% in 2021. These poor scores are largely due to poor record keeping, lack of handover to new staff and lack of a central information system. Despite the tremendous efforts by DPW in 2018 to develop all Green Drop documents, none of the gains were capitalised on, as was evident from the lack of presenting O&M manuals, plant classifications, W₂RAPs, Process Audits, monitoring plans, and many others.

The Regulator thus urges DPW to improve on their record keeping, as this is the primary cause for poor Green Drop scores in general. In the short term, the submission of compliance data to the Regulator needs to be prioritised. Final effluent quality not only constitutes a legal requirement but will also serve to increase the overall Green Drop score in the 2023 audit cycle. Compliance monitoring data was in , but was insufficient to generate a compliance score for Physical, Chemical and Microbiological Categories.

An inter-departmental approach is strongly encouraged for the management of wastewater services, as it seems that many of the records seem to be available but not readily accessible to the Green Drop champion or project management teams. A positive point is that the plant is very well maintained and visibly produce a clear effluent quality – this bodes well for DPW Free State in future audits. A TSA score of 57% versus a 9% GD score for Maseru Bridge were obtained, showing some disconnect between the wastewater administration and fieldwork.

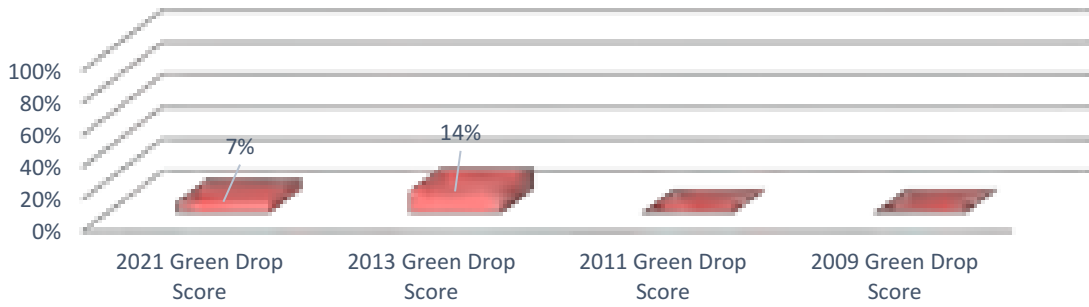
From the audit results, all 5 KFAs need attention, but financial, technical and compliance received overall low/zero scores. The Regulator also notes with concern that no sludge monitoring and no controlled biosolids beneficiation take place, although it was noted that sludge is collected by a farmer for use as fertiliser. There is no standards or SLA in place for this sludge disposal practice and may result in health risks to consumers of the particular farmers produce.

Green Drop findings:

1. The newly appointed project management teams were not acquainted with the technology, design, operations, or maintenance aspects of the systems
2. Full sets of compliance data was not submitted for any of the six (6) systems
3. All W₂RAPs were all out of date and lacked implementation
4. No financials (budget, expenditure, capital projects) were provided for any of the systems – noting that the DPW systems present a challenge to retrieve such information
5. Zero sludge monitoring or classification in place for any of the systems
6. Monitoring and record keeping of flow is lacking to questionable at best
7. All six plants are in the high-risk positions
8. No capital refurbishment was presented for any of the networks, pumpstations or WWTWs.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.

Green Drop History



Technical Site Assessment

Maseru Bridge Port of Entry WWTW 57%

The **Maseru Bridge Port of Entry** was inspected to verify the Green Drop audit findings:

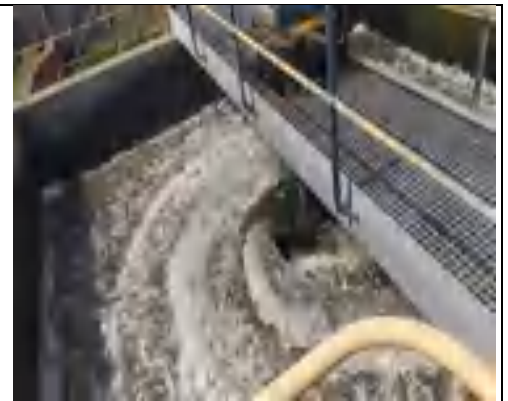
- Maseru Bridge Port of Entry WWTW was used as a learning opportunity for juniors at DPW – this presented an excellent knowledge transfer opportunity
- The project manager and plant staff did not seem familiar with the plant specific operations and maintenance manual
- Major leakage was observed at the sewer network
- The WWTW was very well maintained and neatly fenced
- No signage or classification certificates were displayed
- Offices double as storage facilities
- Sludge withdrawal equipment was dysfunctional
- Sludge was not disposed of adequately and is collected by a farmer and no SLA is in place
- Civil structure was in a very good condition and well maintained
- Mechanical equipment needed attention, as one mixer, the clarifier and RAS pumps were offline
- RAS pumps have been offline for 1.5-years, and therefore no sludge recycling takes place
- Flow meter readings were unreliable as the flow meter short circuits during periods of rainfall.



Sludge withdrawal dysfunctional



Leakage in sewer network



Operational control could be improved

4.4 Gauteng (Johannesburg) Region

Water Service Institution	DPW Johannesburg	
Water Service Provider	Blessing Engineering Services	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	22%↑	1. Infrastructure in satisfactory condition
2013 Green Drop Score	0%	2. Improvement needed mostly on the operation of the plant
2009-11 Green Drop Score	NA	3. In particular monitoring of process units, flow monitoring, sludge withdrawal from settlers, anaerobic digesters, sand replacement in the drying beds.
		VROOM Estimate: - R124,000

Key Performance Area	Weight	Devon
A. Capacity Management	15%	34.0%
B. Environmental Management	15%	40.0%
C. Financial Management	20%	7.5%
D. Technical Management	20%	31.0%
E. Effluent & Sludge Compliance	30%	9.0%
F. Bonus		9.5%
G. Penalties		-25.0%
H. Disqualifiers		None
Green Drop Score (2021)		22%
2013 Green Drop Score		0%
2009-11 Green Drop Score		NA
System Design Capacity	MI/d	0.2
Capacity Utilisation (%)		85%
Resource Discharged into		Irrigation
Microbiological Compliance	%	Insufficient data set
Chemical Compliance	%	Insufficient data set
Physical Compliance	%	Insufficient data set
Wastewater Risk Rating (CRR% of CRR_{max})		Devon
CRR (2011)	%	100.0%
CRR (2013)	%	100.0%
CRR (2021)	%	76.5%

Regulator's Comment:

The DPW Johannesburg Region is commended for improving from 0% to 22% since 2013. The Devon team showed commitment to and appreciation for the DWS consultative audit process and engaged actively during the audit. The presence of national and regional managers bodes well for further improvement towards the GD 2023 audit. Regrettably, the Johannesburg team was not very well prepared for the full audit scope and lack evidence on final effluent compliance, functional laboratory services, IRIS data, and operational knowledge.

Despite the presentation of very good process audits, asset registers, O&M manuals, and sludge management plans, none of these were implemented, some outdated, and not used to inform improvement strategies. A major risk is presented in terms of the O&M contractual aspects, specifically related to supervisory, operational and maintenance aspects. No performance requirements are in place to safeguard final effluent or sludge quality, the latter which are used to grow food for human consumption. Maintenance, engineering, and scientific capabilities of the organisation will need to be strengthened. The audit team noted that the national DPW Green Drop that was initiated by the DPW Director General in 2017 did not materialise in terms of its intent to be Green Drop ready by 2021 and did not find its way to implementation. Despite the commendable effort of the national DPW coordinator, valuable audit evidence such as monitoring regimes and skills development were not presented as evidence.

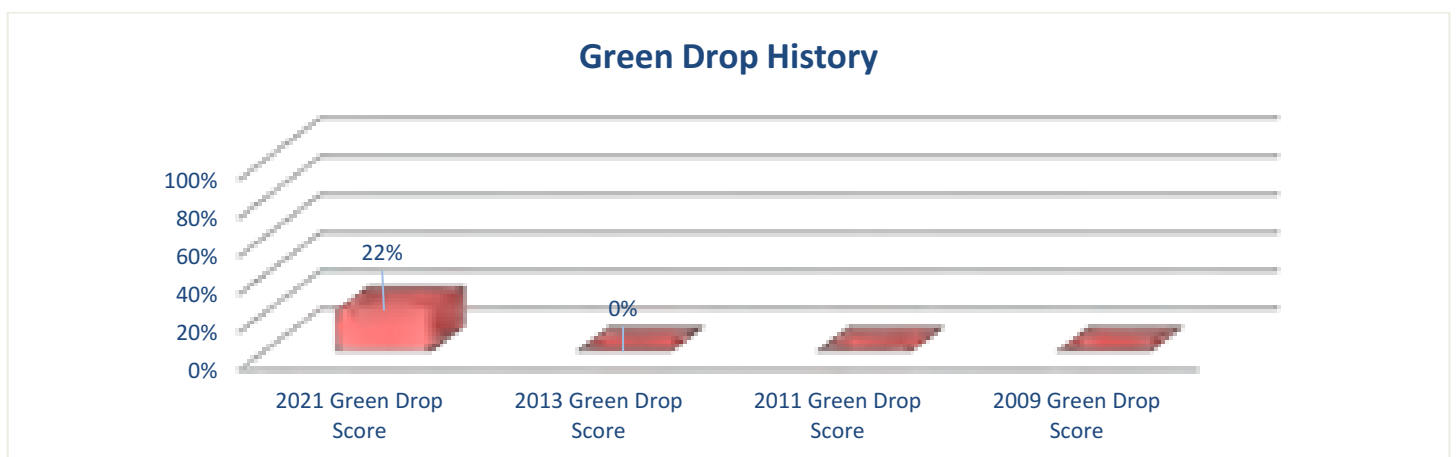
In light of the above, a number of improvement opportunities can be identified for this system. The 2017/18 information and templates need to be revived, updated, and implemented. The O&M contracts need to re-design to stipulate legislative compliance and industry good practice and need to be enforced by DPW managers. Skills development in the operations and management of wastewater processes and infrastructure is key to further improvement. Commitment and oversight by senior management need to be intensified. Credible data from the laboratory and field instrumentation is an eminent risk and need to be addressed via the W₂RAP process and IRIS reports to the DWS.

The Devon team is encouraged to further develop and implement the W₂RAP process as an effective mechanism to reduce the CRR from the current high risk position of 76.5% to lower risk space. The team is applauded for improving on the critical risk position of 100% in 2013 to the current level of 76.5%. However, this improvement appears to be more by default and not by design. Active identification, prioritisation and correction of higher risks will be a good and sustainable turnaround strategy.

Green Drop findings:

1. The Supervisor and majority of Process Controllers are unregistered and do not comply with Reg. 2834 or 813
2. Engineering, scientific, and technical expertise need to be addressed
3. No operational monitoring and limited compliance monitoring could be presented
4. Financial information was largely absent, including budgets and expenditure
5. Flow meters are in place, but data is suspect. Flows are not converted to m³/day and no trend analysis is done
6. The treatment plant does not comply with effluent quality standards, thereby impacting negatively on the receiving environment and public health.

The Regulator is concerned about the overall poor state of wastewater services and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.




Technical Site Assessment

Devon WWTW **66%**

The **Devon WWTW** was inspected to verify the Green Drop audit findings:

- The network and pumpstation were in good condition, with evidence of adequate operations and maintenance
- PFD and incident management protocols were displayed, but operational and maintenance evidence lacking
- The terrain was signposted, fenced, tidy, grass cut and a high staff satisfaction in their workplace was evident
- Flow meters were in place but not calibrated or used to inform process optimisation
- No raw sewage quality or extraneous flows was monitored
- Limited operational monitoring was done, and operational design limits of the process units was unknown
- Desludging of settling tanks and clarifiers were inadequate and contributed to high solids carry-over to final effluent channels and high chlorine demand
- Biofilters were functional and delivered a visually clear effluent, some structural defects were noted in the biofilter walls
- Final effluent channels were clean but carried a high solids effluent, the chlorine equipment was in good condition and well operated
- Safety was well attended to, e.g. protective clothing, BA kit, signage, and certificates of chlorine handling

- Sludge treatment was functional, and structures were in good condition. However, operational procedures and monitoring were absent for the anaerobic digesters and sludge drying beds, no sand replacement took place
- Final sludge is visually dry and of high quality.

 <p>WELCOME TO DEVON CORRECTIONAL CENTRE CORRECT 12782 001 9811 + 9825 WE SERVE WITH PRIDE</p>	 <p>Primary and secondary sludge accumulation as result of sludge withdrawal practice not optimised</p>	 <p>Sludge beds well maintained and biosolids free of odour and well dried</p>
<p><i>Signage and security in place at the entry of the prison facility and treatment plant</i></p>	<p><i>Primary and secondary sludge accumulation as result of sludge withdrawal practice not optimised</i></p>	<p><i>Sludge beds well maintained and biosolids free of odour and well dried</i></p>

4.5 Gauteng (Pretoria) Region

Water Service Institution	DPW Pretoria		
Water Service Provider	DPW Pretoria		
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):		
2021 Green Drop Score	12%↑	1. Disinfection	
2013 Green Drop Score	1%	2. Hydraulic overloading	
2009-11 Green Drop Score	NA	3. Distribution box overflow	
		4. Sludge and Effluent Pumps	
		VROOM Estimate:	
		- R26,076,000	

Key Performance Area	Weight	Boekenhouts-kloof 1 MB	Boekenhouts-kloof 2 MB	Central Advanced Training	Zonderwater Prison
A. Capacity Management	15%	27.0%	2.5%	27.0%	22.0%
B. Environmental Management	15%	42.0%	10.0%	40.0%	18.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	10.5%	8.8%	25.5%	0.0%
E. Effluent & Sludge Compliance	30%	3.0%	3.8%	3.0%	20.0%
F. Bonus		19.5%	15.0%	19.5%	19.5%
G. Penalties		-25.0%	-25.0%	-25.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		11%	2%	13%	10%
2013 Green Drop Score		0%	0%	0%	4%
2009-11 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.045	NI	0.045	2
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Evaporation dam	Evaporation dam	Tributary of Hartbeespoort Dam	Irrigation crops
Microbiological Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	Insufficient data set
Chemical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	Insufficient data set
Physical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	Insufficient data set
Wastewater Risk Rating (CRR % of CRR_{max})		Boekenhouts-kloof 1 MB	Boekenhouts-kloof 2 MB	Central Advanced Training	Zonderwater Prison
CRR (2011)	%	64.7%	NA	70.6%	76.5%
CRR (2013)	%	82.4%	NA	58.8%	88.2%
CRR (2021)	%	100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Ditholo Military Base	Roodeplaat Dog School	Thaba Tshwane	Wallmansdahl Military Base
A. Capacity Management	15%	27.0%	27.0%	30.0%	29.0%
B. Environmental Management	15%	40.0%	40.0%	42.5%	32.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	25.5%	25.5%	30.0%	25.5%
E. Effluent & Sludge Compliance	30%	3.0%	3.0%	3.8%	0.0%
F. Bonus		19.5%	15.0%	19.5%	19.5%
G. Penalties		-25.0%	-25.0%	-25.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		13%	13%	15%	11%
2013 Green Drop Score		0%	0%	0%	0%
2009-11 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.09	0.512	3	3

Key Performance Area	Weight	Ditholo Military Base	Roodeplaat Dog School	Thaba Tshwane	Wallmansdahl Military Base
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Veld discharge	Pienaars River	Irrigation – crops and golf course	Evaporation ponds
Microbiological Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	No monitoring
Chemical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	No monitoring
Physical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	No monitoring
Wastewater Risk Rating (CRR % of CRR _{max})		Ditholo Military Base	Roodeplaat Dog School	Thaba Tshwane	Wallmansdahl Military Base
CRR (2011)	%	58.8%	82.4%	58.8%	58.3%
CRR (2013)	%	88.2%	88.2%	88.2%	70.6%
CRR (2021)	%	100.0%	100.0%	94.1%	100.0%

Regulator's Comment

Historically, the DPW wastewater systems under-performed against the Green Drop criteria. For the 2021 audits, the Department's performance is still not on par with the Regulator's expectations, however, the DPW Director General's efforts of 2017/18 managed to improve the DPW Pretoria Region's GD score from 1% to 12%. Some documentation was excellent; however, it was undermined the lack of implementation. Inconsistency was noted across different DPW regions, with some regions and systems having different levels information available, although the DPW Director General's programme delivered the same documents for all systems. Overall, the DPW Pretoria DPW team was not well prepared for the assessment and a lack of management commitment and presence contributed to the poor engagement.

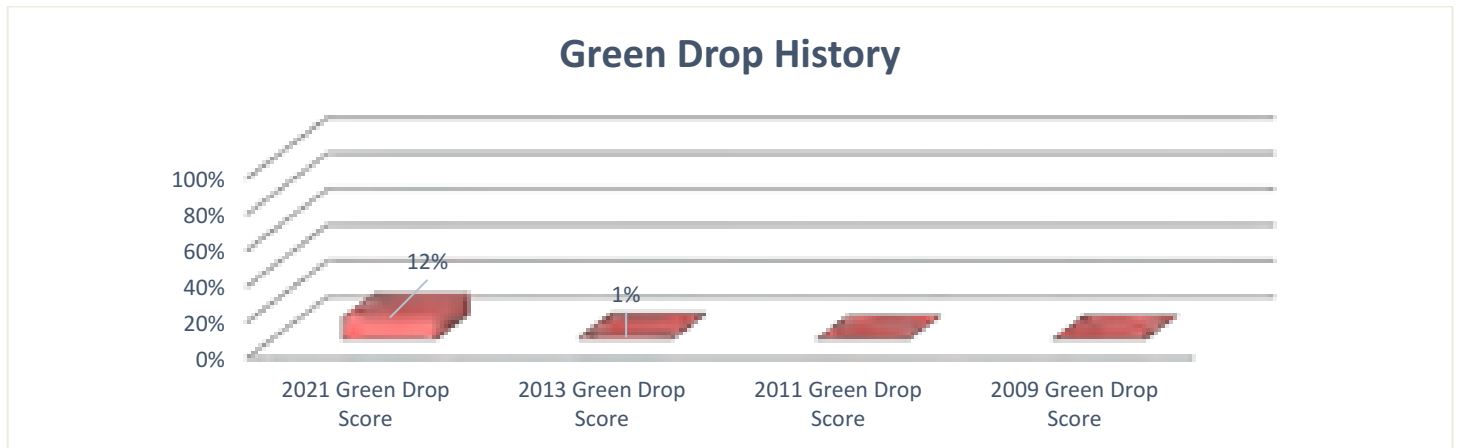
Training of Process Controllers was prioritised during the last year, but the lack of sufficient monitoring of the final effluent for compliance monitoring presents a continued human health risk. Quick results can be achieved by training more staff on the IRIS system and by providing competent supervision to ensure that staff are available and able to operate, monitor and maintain WWTWs. There are many sites where no flow meter readings are taken, and this should be prioritised along with credible laboratory data and competent Process Controllers. The lack of flow metering and final effluent quality attract penalties, and should be avoided at all cost leading up to the 2023 audits.

Financial information and budget requirements for the effective operation and maintenance of the WWTW should be prioritised by management. While it is clear that there are several upgrade and refurbishment projects in place, knowledgeable technical management would be required to ensure that the DPW raise their performance and legal compliance to a minimum level, before taking a final leap towards excellence.

Green Drop Findings:

1. The majority of Process Controllers are not registered on the IRIS system and there is a lack of shift schedules at many plants
2. Insufficient qualified staff for all plants can be observed via non-compliance with Regulation 2834 or draft Reg. 813, resulting in a lack of operational control at the plants
3. Very limited compliance monitoring takes place, compounded by zero operational monitoring at all plants
4. The contracts with the Green Drop Champions who were employed by the DPW have come to an end and were not renewed. This is regrettable, as the staff seemed to have gained significant know-how during this process
5. No engineering or scientific competency exist at any of the systems
6. Financial information was sparse to non-existing, and no understanding of O&M cost determination is evident
7. Some documentation available was good and there is evidence of attempting to improve the performance of the DPW in terms of wastewater management
8. Very good asset registers, W₂RAPs and Process Audits were evident for 6-7 of the 8 systems, however, no implementation of the recommendations were observed
9. Zero of the 8 systems complied with legal effluent quality standards
10. All treatment plants are in critical risk positions with all systems attaining GD scores of ≤15%
11. Capital projects are planned, and tenders submitted for the following systems, however, no funding has been secured at time of the audits:
 - R12,566,274: Upgrade of Boekenhoutskloof WWTW
 - R1,939,505: Upgrade for Centre of Advanced Training (CAT)
 - R23,518,242: Upgrade of Zonderwater WWTW
 - R2,050,565: Upgrade of Dithlolo WWTW
 - R7,646,873: Upgrade of Thaba Tshwane WWTW
 - R10,699,329: Upgrade of Wallmansthal WWTW.

The Regulator is concerned about the poor state of wastewater services and the consequential impact on the water resources and require the WSI to submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Thaba Tshwane WWTW 33%

The **Thaba Tshwane WWTW** was inspected to verify the Green Drop audit findings:

- Raw flow meter is installed but not commissioned
- Contractor is on site and has taken half the PST's and biofilters out of commission for month which has increased the hydraulic and organic pressure on the works
- The single biofilter which is in operation, is severely overloaded; the distribution arm is rotating very fast due to the excessive flows, uneven distribution of flow evident – minimal treatment efficiency can be expected under these operational conditions
- Distribution box to biofilter overflows due to the overloading of the biofilter during construction. No attempt was made to mitigate this risk and the untreated effluent bypasses the treatment process to the final effluent
- SST overflow is turbid due to the hydraulic burden, resulting in high solids discharged
- Disinfection was done by HTH tablets which is ineffective as no dosage is determined and effluent is very poor quality
- Effluent was not clear, high in suspected solids, and sludge floating in effluent
- PFD and IMP were displayed with classification certificate
- No process monitoring equipment was available on site and no daily logbooks were available
- Operational knowledge must be addressed, as pertaining to the specific technology and design parameters of this site
- Sludge was stockpiled on site with no beneficiation evident
- Pump station pump presented only one working pump, the other is not operational so cannot perform in duty/ standby configuration.



4.6 KwaZulu Natal (North) Region

Water Service Institution	DPW KZN North	
Water Service Provider	DPW KZN North	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	0%↓	1. Contractual challenges in terms of operations and maintenance
2013 Green Drop Score	19%	2. Acceptable civil infrastructure in place but most mechanical equipment is under strain and require immediate maintenance and repair
2009-11 Green Drop Score	NA	3. Biofilter effluent distribution arms
		4. Damaged bridges and walkways on settlers
		5. Operation and monitoring lacking.
		VROOM Estimate:
		- R14,456,420

Key Performance Area	Weight	Onverwacht Border Post	Mtubatuba SANDF	Esibayeni SAPS	Ubombo SAPS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		34%	18%	5%	13%
2011 Green Drop Score		0%	8%	0%	0%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.02	0.7	0.1	0.1
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Land Irrigation	Wetland	Unknown	Artificial Wetland
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Onverwacht Border Post	Mtubatuba SANDF	Esibayeni SAPS	Ubombo SAPS
CRR (2011)	%	67.7%	58.8%	NA	88.2%
CRR (2013)	%	82.4%	88.2%	100.0%	100.0%
CRR (2021)	%	100%	100%	100%	100%

Key Performance Area	Weight	Golela Border Post	Ingwavuma SAPS	Ndumo SANDF	Emanguzi SAPS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		16%	5%	8%	7%

Key Performance Area	Weight	Golela Border Post	Ingwavuma SAPS	Ndumo SANDF	Emanguzi SAPS
2011 Green Drop Score		12%	0%	0%	0%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.1	0.1	0.1	0.06
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Artificial Wetland	Artificial Wetland	Artificial Wetland	French Drain
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Golela Border Post	Ingwavuma SAPS	Ndumo SANDF	Emanguzi SAPS
CRR (2011)	%	58.8%	NA	94.1%	NA
CRR (2013)	%	100.0%	100.0%	100.0%	88.2%
CRR (2021)	%	100%	100%	100%	100%

Key Performance Area	Weight	Glencoe Prison	Hlobane SAPS	Ncome Prison	Waterval Prison
A. Capacity Management	15%	0.0%	0.0%	20.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	-50.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		38%	15%	27%	23%
2011 Green Drop Score		8%	12%	0%	0%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.52	0.02	0.88	1
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Buffalo River via unknown stream	Artificial Wetland	Blood River via Endlhevenu stream	Buffalo River
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Glencoe Prison	Hlobane SAPS	Ncome Prison	Waterval Prison
CRR (2011)	%	47.1%	64.7%	64.7%	47.1%
CRR (2013)	%	64.7%	70.6%	82.4%	82.4%
CRR (2021)	%	100%	100%	94.1%	100%

Key Performance Area	Weight	Ekuseni Youth Centre
A. Capacity Management	15%	0.0%
B. Environmental Management	15%	0.0%
C. Financial Management	20%	0.0%
D. Technical Management	20%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%
F. Bonus		0.0%
G. Penalties		-50.0%
H. Disqualifiers		None

Key Performance Area	Weight	Ekuseni Youth Centre
Green Drop Score (2021)		0%
2013 Green Drop Score		17%
2011 Green Drop Score		6%
2009 Green Drop Score		NA
System Design Capacity	MI/d	0.16
Design Capacity Utilisation (%)		NI
Resource Discharged into		Unknown
Microbiological Compliance	%	No monitoring
Chemical Compliance	%	No monitoring
Physical Compliance	%	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Ekuseni Youth Centre
CRR (2011)	%	58.8%
CRR (2013)	%	70.6%
CRR (2021)	%	100%

Regulator's Comment:

The DPW KZN North Region attended the audited and welcomed the audit team and facilitating site visits. The team was not well prepared as was evident from the 0% Green Drop score, which amount to regress from the 2019 score of 19%. The following systems are still not registered on the IRIS and should be registered soonest: Esibayeni SAPS, Ubombo SAPS, Golela Border Post, Ingwavuma SAPS, Ndumo SANDF, and Emanguzi SAPS.

It is regrettable that the efforts and investment to become Green Drop ready in 2018, did not bear fruit for KZN. Despite an extensive programme undertaken and driven by DPW national, the Region was ill equipped with evidence and knowledge of their wastewater systems. No implementation of corrective measures has taken place since 2013. The Regulator is disappointed by the current state of wastewater services, of which a 0% Green Drop score reflects a lack of management, ownership, compliance, and good practice. The Region could turn this situation around by acquiring the Green Drop plans, drawings and registers from 2017, and use these as a foundation to improve and excel towards the Green Drop audit cycle of 2023.

The single highest risk that the DPW is facing is the reliance on outsourced O&M and prolonged internal systems. A lengthy administration procedure requires a fault to be logged then communicated to the correctional services or related government department, who in turn, log the fault to the national call centre to get a reference number, order number plus various verification process in between before an approved work order can be issued to the contractor. Long downtime affects operation of the works and impacts on the quality of the final effluent reaching the environment. The maintenance issues translate to operations as well, where the absence of sampling, monitoring, and process control result in infrastructure not being operated to standard operational procedures. DPW is strongly urged to re-evaluate its maintenance and operational protocol and contracts to ensure that works are operating according to O&M manuals and to required licence and authorisation requirements.

The Regulator is further dissatisfied by the lack of information uploaded to IRIS for evaluation, which was highlighted at the confirmation sessions, considering that a high number of DPW staff was trained by the Department (DWS) in 2018. The current status of wastewater services requires the highest possible intervention by DPW executives and political leadership. A good start would be to revive the 2018 Green Drop project via DPW national office, and commence by getting the basics in place.

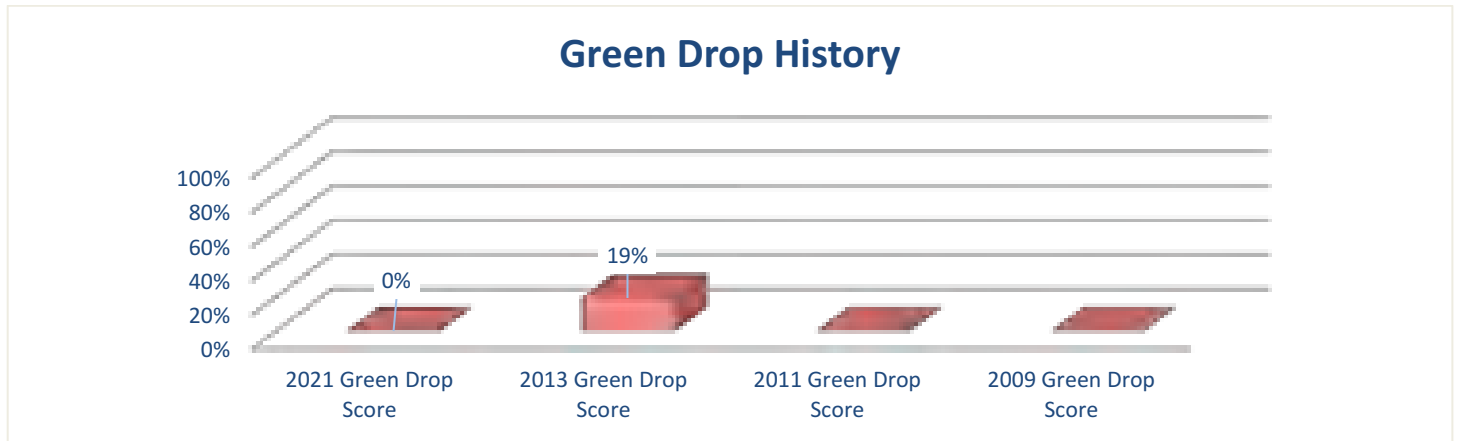
Issues with contractors seems to be a national risk to DPW and could be resolved by firming up performance-based agreements, which include qualified, registered operators and plant managers, introduction of operational monitoring, and compliance with effluent and sludge standards. The Green Drop Standards could be held as norm for future services providers. The Regulator is concerned about the Ncome Prison WWTW which is a relatively new plant, but is failing its purpose as result of poor operational practice and staff stressors. DPW leadership need to prioritise an intervention.

Green Drop findings:

1. The works classification needs to be completed for certification
2. Finalisation of Process Controller applications needs to be completed and updated
3. Flow monitoring is to be reinstated and kept track of and analysed
4. Operational and compliance monitoring needs to take place and uploaded to IRIS

5. Correct information must be populated on IRIS and the DWS need to be informed on the operations and compliance of these works, as they are negatively impacting on the environment
6. Improved operation and maintenance protocols to be put into place to ensure that works are operating at acceptable levels
7. All plants are in the critical risk positions
8. No capital plans or business plans were offered to address the deficiencies noted.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Two site inspections were undertaken to confirm the Green Drop desktop audit findings: Waterval- and Ncome Prisons:

Waterval Prison 59%

The **Waterval Prison** was inspected to verify the Green Drop audit findings:

- The works has an incomplete classification
- The plant was relatively well maintained in terms of infrastructure, however, operation and management and documentation was being challenged by the weakened relationship between the contractor and DPW
- Not much documentation could be presented or uploaded to IRIS
- Only compliance monitoring was taking place once a month but was not being uploaded to IRIS by the contractor or DPW staff
- If not for the maturation ponds at the end of the process, this works would fail in terms of treatment of final effluent
- If the current trend of operation is continued, it will result in the works becoming not functional – this would pose a serious risk to the receiving environment. Hence, early intervention is required.

<p><i>Terrain is neat and civil infrastructure in acceptable condition</i></p>	<p><i>Severe pooling and poor flow distribution render the biofilters ineffective</i></p>	<p><i>The maturation ponds as final process unit comes to a rescue where the upstream processes are failing. No final effluent is being done, no performance management done.</i></p>

The **Ncome Prison** was inspected to verify the Green Drop audit findings:

- The works also has an incomplete classification – this is a legal indictment
- The plant is relatively well maintained in terms of infrastructure, however, the operations, management and documentation seems to be challenged by the weakened relationship between the contractor and DPW
- Little documentation could be presented or has been uploaded to IRIS in conforming with the Portfolio of Evidence request issued by the Regulator
- This works was in a state of serious failure. Operation of the works was reduced to a mode of recirculating the ‘treated’ liquid and sludge, rendering the activated sludge septic (black and odorous), with no life biomass – this is very poor practice and need to discontinue with immediate effect
- The final effluent is returned to a holding dam, is accessible to cattle and humans which poses a health risk
- This treatment works is relatively new and has the required infrastructure to treat the effluent to the required mandatory standards, given that the wastewater consists of domestic origin only.

		
<p><i>The site is very neat grass cut and well maintained</i></p>	<p><i>Septic conditions in the activated sludge reactors, coupled with prolonged lack of operation and contract management issues</i></p>	<p><i>Relatively new infrastructure is not performing to design intention, with solids carry over from the final settling dams before chlorination. No sampling or operational control takes place.</i></p>

4.7 KwaZulu Natal (South) Region

Water Service Institution	DPW KZN South	
Water Service Provider	uMzinyathi DM (Kranskop Prison)	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	14%↓	1. Pump station mechanical screen and standby pump
2013 Green Drop Score	28%	2. Inflow and outflow meters
2011 Green Drop Score	6%	3. Aerator no. 1 in the Pasveer ditch
2009 Green Drop Score	NA	4. 1 no. RAS pump, 1 no. irrigation pumps, sludge return pump, balancing tank pump, and WAS pumps including some leaking and dysfunctional valves
		5. Electrical issue with tripping of outflow meter
		6. Electrical damage to panel that serves the irrigation pumps
		VROOM Estimate:
		- R1,230,650

Key Performance Area	Weight	Kranskop Prison	Mthunzini Prison	New Hanover Prison	Sevontein Prison
A. Capacity Management	15%	46.0%	48.0%	36.0%	46.0%
B. Environmental Management	15%	29.0%	29.0%	29.0%	29.0%
C. Financial Management	20%	4.5%	4.5%	4.5%	4.5%
D. Technical Management	20%	21.0%	21.0%	21.0%	21.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	15.0%
F. Bonus		0.0%	9.5%	3.8%	0.0%
G. Penalties		-25.0%	-25%	-50.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		12%	13%	7%	16%
2013 Green Drop Score		12%	30%	24%	28%
2011 Green Drop Score		9%	6%	6%	5%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.1	0.1	0.067	0.5
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Mandeleni to Tugela	Umalalazi	Injasuthu to Sterkspruit	Msunduzi via stream
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Kranskop Prison	Mthunzini Prison	New Hanover Prison	Sevontein Prison
CRR (2011)	%	NA	NA	NA	NA
CRR (2013)	%	35.0%	35.0%	41.0%	59.0%
CRR (2021)	%	100%	94.1%	100.0%	94.1%

Key Performance Area	Weight	Wartburg SAPS
A. Capacity Management	15%	40.0%
B. Environmental Management	15%	29.0%
C. Financial Management	20%	4.5%
D. Technical Management	20%	21.0%
E. Effluent & Sludge Compliance	30%	0.0%
F. Bonus		3.8%

Key Performance Area	Weight	Wartburg SAPS
G. Penalties		-25.0%
H. Disqualifiers		None
Green Drop Score (2021)		11%
2013 Green Drop Score		21%
2011 Green Drop Score		3%
2009 Green Drop Score		NA
System Design Capacity	MI/d	0.048
Design Capacity Utilisation (%)		NI
Resource Discharged into		Irrigation to farmer (off-flow to Nhlambamasoka stream, tributary to Umgeni River)
Microbiological Compliance	%	No monitoring
Chemical Compliance	%	No monitoring
Physical Compliance	%	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Wartburg SAPS
CRR (2011)	%	NA
CRR (2013)	%	47.0%
CRR (2021)	%	100%

Regulator's Comment:

DPW KwaZulu Natal South owns and operate 4 wastewater systems. A Service Level Agreement is in place for the Kranskop Prison system with the uMzinyathi District Municipality. Regrettably, the 14% overall score shows that KZN South Region is not on par with legal requirements nor good practice standards. The regressive trend from the 2013 Green Drop score of 28% is noted with concern. All systems have also digressed into the critical risk space obtaining CRR risk ratings above 90%. The administrative deficiencies is echoed by the results of the Technical Site Inspection of the Sevontein system which indicate a major recession from 84% in 2013 to 43% in 2021.

The DPW KZN South struggled to access and submit evidence for their respective systems. Most of the evidence submitted, was sourced from the National DPW Turnaround Plan project completed in 2017, with the main thrust of the Plan having been to bring about change in the Department's operation of their WWTWs, and to address deficiencies and areas of non-performance through a 3-phased process. These being:

- Phase 1 - Stabilisation (to set the baseline performance);
- Phase 2 - Efficiency (to introduce efficiencies); and
- Phase 3 - Sustainability and Growth (introduce initiatives that bring and embed change in organisational culture).

Very good W₂RAPs (including IMPs), Process Audits, operational and compliance monitoring programmes, sludge management plans, O&M manuals, asset registers, etc., were developed; the Works were classified, and the process controlling staff were registered and certified as part of Phase 1 of the Plan. However, the DPW KZN South does not appear to have progressed beyond Phase 1 and the impetus has thus been lost with almost no proof of implementation of the Plan and no demonstrable evidence of progression from Phases 1 to 3. Dissemination difficulties around the release of the various reports, tools, and information, prepared during the Turnaround Plan, should be addressed and renewed effort directed to reissue the reports and refresher training. This will allow the Region to use the 2017 foundation to build capacity and update plans, and to be Green Drop ready by 2023 when the next audit season commences.

The short-term outsourcing of contractors to operate and maintain the systems for systems for 3 months, should be assessed as part of the next risk review for its potential impact/disrupting of the medium-to-long term operation and maintenance objectives and losing momentum at the respective systems. The recent decision to have 3-year O&M contracts in place, may be more sustainable. However, it is recommended that DPW KZN South appoint PSPs on the basis of competence, registered PC and suitable technical qualification, coupled with compliance to Green Drop Standards as performance criteria. Likewise, it is critical that adequate KPIs and oversight measures be put in place to manage and monitor adherence against compliance requirements. Ultimately, it is the DPW who is held accountable by the Regulator, not the PSP. Management intervention, correction, and accountability from DPW national

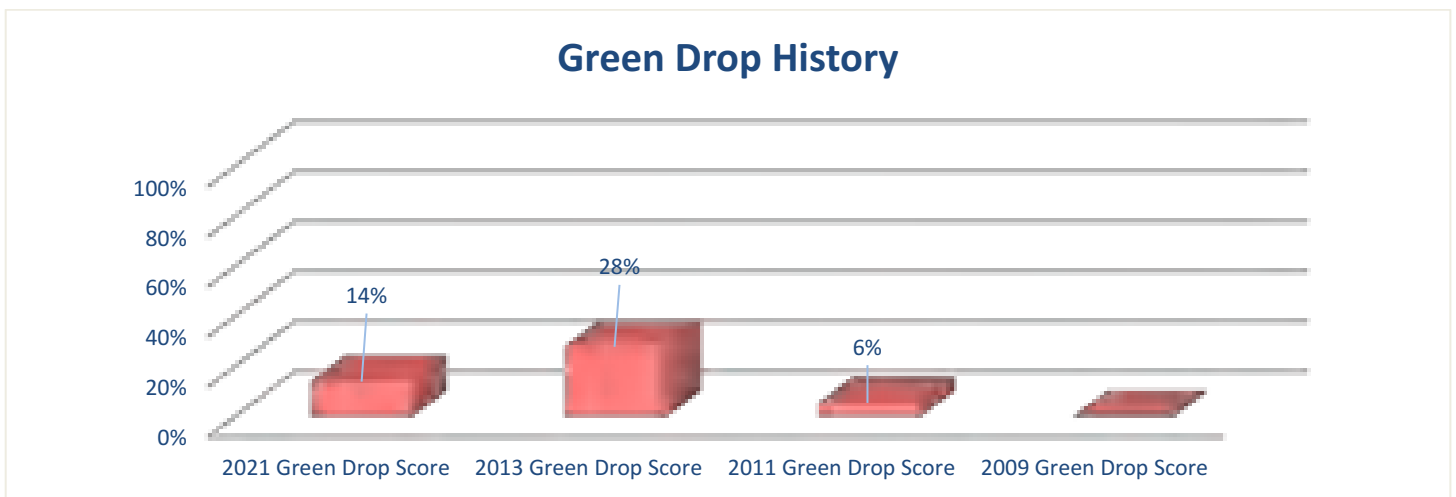
and region is urgently required, as (deficient) contractor competency and performance-based contract procurement/ management seem to be a critical risk across many DPW regions.

Short term gains can be effected by prioritising the implementation of performance-based contracts, flow metering, compliance monitoring and upskilling/equipping the laboratory to conduct credible analysis with short turnaround times. The W₂RAP should be reinstated and updated to drive compliance and monitor implementation against the risk targets (which align with Green Drop standards).

Green Drop findings:

1. No certificated Process Controllers
2. No maintenance teams in place, no logbooks with maintenance & repair entries, including contracts or SLAs with service providers and suppliers
3. No engineering staff available for planning, oversight and monitoring of operations, maintenance and general asset management
4. No evidence of in-house or externally appointed scientific staff for the required scientific services
5. Lack of operational and compliance monitoring results uploaded on IRIS
6. No water-use authorisations in place for any of the WWTWs
7. Updated W₂RAPs and Process Audits are not in place and/or not implemented
8. Updated asset register and preventative/corrective maintenance plans are not in place
9. Sewer collection system inspections and reporting is lacking
10. No cost determination being done, and no budget and expenditure figures provided for - hence not possible to establish the cost of treatment
11. No energy efficiency management in place
12. No evidence of flow metering (functional flow meters and or manual flow reading), measurement and recording (inflows and outflows) including COD loads, rainfall, minimum night flows, and no proof calibration of the inflow and outflow meters
13. All five plants are situated in the critical risk positions
14. No bonus scores were claimed, except for training over the covid period and water conservation and demand management initiatives established by Reonet at the Mthunzini Prison.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Sevontein Prison WWTW 42%

The **Sevontein Prison WWTW** was inspected to verify the Green Drop audit findings:

- No inspections of the sewer network were undertaken by the contractors, as it is not part of the contract – only blockages are dealt with
- The pump station was in the open environment with high fencing, but has been compromised with holes along the fence perimeter. The gate was not locked or secured, and no safety signage was visible
- The treatment plant was not sign-posted and old sections of the concrete palisade fence was in a state of disrepair
- The terrain and grounds were well kept, except for weed control in the concrete structures
- No classification certificates, process flow diagrams and/or incident management protocols were displayed on-site
- An O&M manual was available but in a terrible condition
- The O&M and repairs logbooks showed the regular recording and reporting of issues, but is often just a repeat of previous entries that were not adequately addressed
- No process monitoring taking place on-site, despite the logbook showing ongoing requests for test kits
- The bathrooms and office facilities were in a fair condition with some refurbishment required
- Safety signage in general was very limited or old or no longer relevant
- The MCC was in good condition and accessible
- The mechanical screen at the inlet was not operational
- Both inflow and outflow meters were not functional
- No maintenance schedule was available and/or implemented
- 1 of 2 aerators were working in the Pasveer ditch
- The WAS pumps were not working, and no sludge was being wasted to the sludge drying beds
- 1 of 2 RAS pumps were working
- The ferric-chloride unit had not been decommissioned safely and was leaking and permeating through the walls and onto the floor of the building and has become a health and safety hazard. A decision needs to be made as to whether the FeCl_3 unit needs to be properly decommissioned or recommissioned
- The Pasveer ditch concrete structure is aging and needs some refurbishment. The cracks and concrete joints are compromised with vegetation growth and water seepage into these joints, with structural cracks will that is compromising the steel reinforcing and the structural integrity of the ditch
- Scum on surface of the new clarifier was noted
- The old clarifier had extensive scum formation on the surface, the manual scum skimmer could not rotate, and the stilling basin was filled with scum and sludge.
- HTH chips were used for disinfection, but dosing was not taking place during the site inspection as there was no HTH in stock for the past 2 weeks
- The irrigation pond needs to be cleaned out, full of vegetation and questionable functionality.



The palisade fence in a state of disrepair



The inflow meter is not working



1 of 2 aerators are dysfunctional in the Pasveer ditch

4.8 Limpopo Region

Water Service Institution	DPW Limpopo		
Water Service Provider	DPW Limpopo		
Institution Green Drop Score	Vroom Impression (Towards restoring functionality):		
2021 Green Drop Score	3%↓	1. Flow meter calibration	
2013 Green Drop Score	18%	2. Spare aerator motor	
2009-11 Green Drop Score	NA	3. Safety and security of WWTWs	
		4. Sludge lagoons	
		VROOM Estimate:	
		- R658,000	

Key Performance Area	Weight	Acornhoek SAPS	Beit Bridge PoE	Hoedspruit MB	Hoedspruit Boston
A. Capacity Management	15%	0.0%	20.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	3%	0%	0%
2013 Green Drop Score		7%	20%	3%	5%
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NA	0.4	NA	NA
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NA	Limpopo River	NA	NA
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Acornhoek SAPS	Beit Bridge PoE	Hoedspruit MB	Hoedspruit Boston
CRR (2011)		NA	NA	NA	NA
CRR (2013)		100.0%	88.2%	100.0%	100.0%
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Hoedspruit MB - BVVA	Hoedspruit MB - HQ	Hoedspruit MB - 85SQ	Hoedspruit MB - 19SQ
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		20%	27%	27%	20%

Key Performance Area	Weight	Hoedspruit MB - BVVA	Hoedspruit MB - HQ	Hoedspruit MB - 85SQ	Hoedspruit MB - 19SQ
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NI	NI	NI	NI
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NI	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Hoedspruit MB - BVVA	Hoedspruit MB - HQ	Hoedspruit MB - 85SQ	Hoedspruit MB - 19SQ
CRR (2011)		NA	NA	NA	NA
CRR (2013)		100.0%	76.5%	70.6%	94.1%
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Hoedspruit Military - 400SQ	Hoedspruit Military - 514SQ	Hoedspruit 7 SU	Leboeng SAPS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		20%	20%	NA	23%
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NI	NI	NI	NI
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NI	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Hoedspruit Military - 400SQ	Hoedspruit Military - 514SQ	Hoedspruit 7 SU	Leboeng SAPS
CRR (2011)		NA	NA	NA	NA
CRR (2013)		94.1%	94.1%	NA	70.6%
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Makhado Airforce	Matatshe CS	Naboomspruit Military	Soekmekaar Magistrate
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None

Key Performance Area	Weight	Makhado Airforce	Matatshe CS	Naboomspruit Military	Soekmeaar Magistrate
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		20%	11%	5%	22%
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NI	NI	NI	NI
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NI	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Makhado Airforce	Matatshe CS	Naboomspruit Military	Soekmeaar Magistrate
CRR (2011)		NA	NA	NA	NA
CRR (2013)		94.1%	88.2%	100.0%	94.1%
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Vuwane Military	Verdrag	Masemola SAPS	Gilead SAPS
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		8%	NA	NA	NA
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NI	NI	NI	NI
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NI	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Vuwane Military	Verdrag	Masemola SAPS	Gilead SAPS
CRR (2011)		NA	NA	NA	NA
CRR (2013)		100.0%	NA	NA	NA
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Key Performance Area	Weight	Siloam	Shilubane	Plantjan PoE	Zanzibar PoE
A. Capacity Management	15%	0.0%	0.0%	0.0%	0.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	0.0%	0.0%	0.0%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%

Key Performance Area	Weight	Siloam	Shilubane	Plantjan PoE	Zanzibar PoE
G. Penalties		0.0%	0.0%	0.0%	0.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		0%	0%	0%	0%
2013 Green Drop Score		NA	NA	NA	NA
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	NI	NI	NI	NI
Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		NI	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Siloam	Shilubane	Plantjan PoE	Zanzibar PoE
CRR (2011)		NA	NA	NA	NA
CRR (2013)		NA	NA	NA	NA
CRR (2021)		100.0%	100.0%	100.0%	100.0%

Regulator's Comment:

The DPW Limpopo Region was ill prepared for the Green Drop audit, despite early notices and guidelines to prepare. No information of evidence was ready to engage or motivate positive scores. The newly appointed person for sanitation in the Limpopo Region was not aware of the regulatory role of the Department of Water and Sanitation, nor of the outcomes of the Green Drop projects launched by national DPW in 2017/2018.

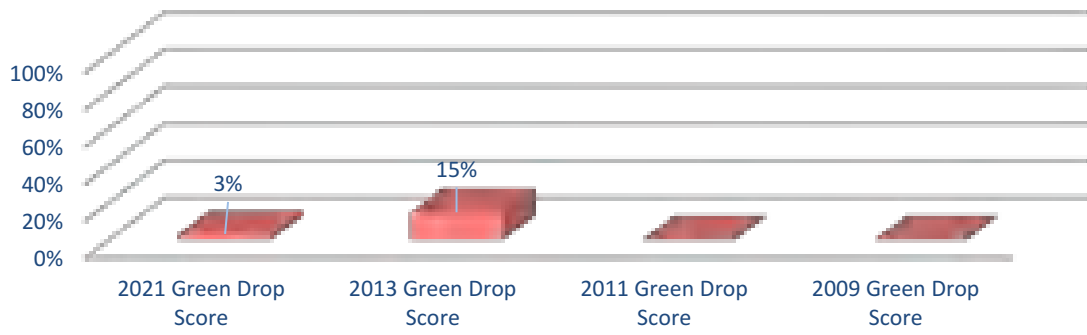
DWS is disappointed about the regressive pattern from the 2013 Green Drop status, and the low level of effort by the Region. Failure to attend to the mere basics of operation and maintenance, and resultant non-compliance to the water laws, requires intervention by top management. A plan of action to rectify the current unacceptable situation with reasonable time frames, budget, and responsibility by DPW must be submitted to the Regulator. All systems received critical state Green Drop scores and are in critical risk CRR positions, which places DPW-Limpopo on the priority list of interventions by the Regulator.

Green Drop findings:

1. The DPW-Limpopo did not prepare for the audit
2. No evidence was presented
3. There is no process control and no sludge management at the WWTW
4. The quality of the effluent is not known, inflow and design capacities unverified, and processes are not managed, impacting the receiving environment negatively
5. The technical capacity of the DPW service providers at the 24 WWTW systems could not be verified
6. All the plants are in critical risk positions.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.

Green Drop History



Technical Site Assessment

Beit Bridge POE WWTW 58%

The **Beit Bridge POE WWTW** was inspected to verify the Green Drop audit findings:

The following observations are relevant:

- The plant and site were in good condition, entrance not signposted
- Classification certificates were displayed during the audit pumpstation readings were taken daily, O&M manual was available, no process monitoring taken place
- Staff facilities neat and clean, minor OSH contraventions noted
- Staff morale under pressure due to payment issues
- Although the process control and monitoring plans as published in the O&M Manual are not implemented, most of the activities are conducted without any results being recorded
- Manual screening functional, no rake, no wheelbarrow, no measurement of screenings
- Grit removal done periodically, structural problems due to aggressive nature of wastewater
- Flow meter in place, but not calibrated
- ASP plant functional, all aerators and RAS pumps working, MLSS not recorded, sludge wasting not recorded, no active control of process was visible or recorded
- Slight sludge bulking on clarifiers, weirs and launders clean and level
- HTH tablets used to chlorinate, no recording of microbiological quality against legal standards
- Sludge drying beds in good condition, sludge lagoons poorly maintained
- Security, safety, and vandalism are major concerns and should be attended to by DPW as a matter of urgency.

<p><i>Clarifier in good condition, minor sludge bulking noted with high sludge bed</i></p>	<p><i>Reedbeds do not contain sufficient vegetation</i></p>	<p><i>Good housekeeping with well-maintained infrastructure</i></p>

4.9 Mpumalanga Region

Water Service Institution	DPW Mpumalanga	
Water Service Providers	Virtual Consulting and Magwa Construction (Mahamba)	
	Superway until end March 2021 Lubisi Consulting (Oshoek)	
	Multinet (Lebombo)	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	20%↓	1. Primary settling tanks
2013 Green Drop Score	28%	2. Biofilters
2009-11 Green Drop Score	NA	3. Anaerobic digesters
		4. Sludge sump pump and general electrical infrastructure require attention
		VROOM Estimate:
		- R8,927,800

NA = Not Assessed/ Audited

Key Performance Area	Weight	Barberton CS	Daggakraal SAPS	Lebombo PoE	Mahamba PoE
A. Capacity Management	15%	52.0%	40.0%	30.0%	25.0%
B. Environmental Management	15%	40.0%	31.0%	51.0%	62.0%
C. Financial Management	20%	10.0%	10.0%	0.0%	29.0%
D. Technical Management	20%	33.5%	7.5%	38.0%	28.5%
E. Effluent & Sludge Compliance	30%	6.0%	0.0%	19.5%	65.0%
F. Bonus		9.5%	0.0%	2.0%	5.0%
G. Penalties		0.0%	-25.0%	-50.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		25%	9%	17%	40%
2013 Green Drop Score		48%	0%	21%	35%
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	l/d	1.184	0.01	0.1	0.076
Capacity Utilisation (%)		59%	NI	200%	NI
Resource Discharged into		Irrigation	Welspruit	Komati River	Mozana stream
Microbiological Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	43%
Chemical Compliance	%	Insufficient data set	NMR	Insufficient data set	100%
Physical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set	100%
Wastewater Risk Rating (CRR% of CRR_{max})		Barberton CS	Daggakraal SAPS	Lebombo PoE	Mahamba PoE
CRR (2011)	%	58.8%	100.0%	82.4%	70.6%
CRR (2013)	%	35.3%	70.6%	58.8%	52.9%
CRR (2021)	%	76.5%	70.6%	88.2%	52.9%

Key Performance Area	Weight	Oshoek PoE	Sandriver MB	Witbank DCS	Zonstraal MB
A. Capacity Management	15%	60.0%	62.5%	50.0%	62.5%
B. Environmental Management	15%	68.0%	15.0%	15.0%	34.4%
C. Financial Management	20%	30.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	37.5%	20.6%	7.5%	8.8%
E. Effluent & Sludge Compliance	30%	21.0%	62.5%	0.0%	18.8%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	-25.0%	-25.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		34%	30%	7%	17%
2013 Green Drop Score		55%	1%	14%	21%
2009-11 Green Drop Score		NA	NA	NA	NA

Key Performance Area	Weight	Oshoek PoE	Sandriver MB	Witbank DCS	Zonstraal MB
Design Capacity	l/d	0.17	0.057	0.631	0.0495
Capacity Utilisation (%)		NI	NI	95%	NI
Resource Discharged into		Komati River	No discharge	Irrigation	Luvuthu River
Microbiological Compliance	%	Insufficient data set	NMR	Insufficient data set	Insufficient data set
Chemical Compliance	%	Insufficient data set	NMR	Insufficient data set	NMR
Physical Compliance	%	Insufficient data set	NMR	Insufficient data set	Insufficient data set
Wastewater Risk Rating (CRR% of CRR_{max})		Oshoek Port of Entry	Sandriver Military Base	Witbank DCS	Zonstraal Military Base
CRR (2011)	%	52.9%	82.4%	100.0%	1.0%
CRR (2013)	%	47.1%	76.5%	64.7%	1.0%
CRR (2021)	%	88.2%	47.1%	76.5%	64.7%

Regulator's Comment:

The DPW Mpumalanga Region is commended for its efforts in preparing for the 2021 Green Drop audit and ensuring that all available information is uploaded on the IRIS. The team displayed a willingness to improve performance and engaged actively in the audit. Despite the presentation of very good process audits, asset registers, O&M manuals and sludge management plans, the compilation of which was initiated by the DPW Director-General in 2017 to improve Green Drop performance, there was little to no evidence of implemented.

The DPW has done well to ensure that all WWTWs were classified, and associated Process Controllers registered. Training of Process Controllers employed by DPW should however be prioritised. The audit team identified the lack of a dedicated operational structure for water and sanitation services at the Regional DPW level as a significant risk. As such, all resources are pooled to conduct operate and maintain all regional assets. Ringfenced financials are not in place for wastewater systems, and hence KPA C could not be satisfied, nor could treatment costs be established. Turnaround times are very poor resulting in equipment breakdowns and general infrastructure maintenance being a lengthy frustrating process, resulting in consistent effluent quality failures, or unknown effluent qualities where these functions are coordinated by the National Office.

Service providers have been appointed to operate and maintain some systems, whereby a risk is presented regarding contract design, monitoring and management related to supervisory, operational and maintenance requirements. No performance measures are in place to safeguard final effluent or sludge quality. It would benefit the DPW to use the Green Drop Standards to inform the scope of work when initiating contracts, and to guide the tools and competencies that are required to meet compliance and ascertain performance.

In light of the above, a number of improvement opportunities can be identified to improve on the Regions' Green Drop performance. The 2017/18 information and reports need to be revived, updated, and implemented. Skills development in the operations and management of wastewater processes and infrastructure is crucial. Commitment and oversight by senior management need to be intensified. Credible data from the laboratory and field instrumentation is an eminent risk and need to be addressed via the W₂RAP process.

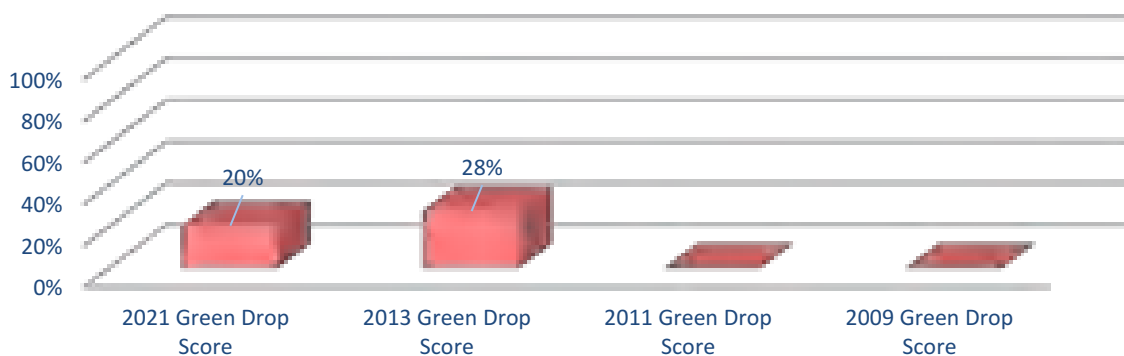
The team is commended for improving on the critical risk position for most systems and in particular the improvement of Green Drop score for the Mahamba Port of Entry. Unfortunately, the poor Green Drop status of 6 wastewater systems, and 5 WWTWs in critical CRR risk positions trigger these systems to be on the regulatory enforcement priority list.

Green Drop findings:

1. W₂RAPs, process audits, sludge management plans and asset registers are in place, but no/limited implementation
2. Financial information was largely absent, including budgets and expenditure
3. Final effluent quality monitoring is inconsistent, and credibility of the laboratory used was not substantiated
4. Inflow meters have been installed at most plants, but meters have been locked and data cannot be accessed
5. No preventative maintenance is practiced and turnaround time for reactive maintenance is poor
6. 5 of the 8 plants are in high-risk positions.

The Regulator is concerned about the overall poor state of wastewater services at Barberton CS, Daggakraal SAPS, Lebombo PoE, Sandriver MB, Witbank DCS and Zonstraal MB systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.

Green Drop History



Technical Site Assessment

Barberton CS WWTW **47%**

The **Barberton CS WWTW** was inspected to verify the Green Drop audit findings:

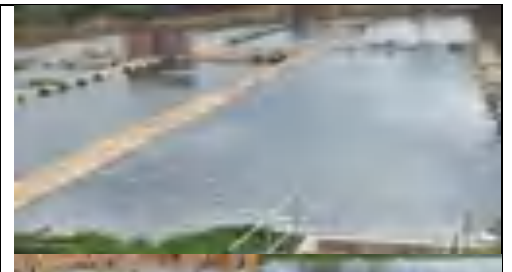
- The site was well-fenced and basic signposting was displayed
- The plant classification certificate was displayed, and process flow diagrams were displayed in the small on-site office. The O&M Manual was also available on-site
- No process monitoring was practiced, however daily operational logs were kept, updated and acknowledged by the plant supervisor
- The grounds were not well-maintained, grass was overgrown with reports of regular encounters with snakes and even crocodiles on occasion
- Evidence of spillages from the inlet and around the PSTs were noted
- The inlet works was well maintained, the single rake screen was free of debris and grit channels did not contain excessive sediment
- An inlet meter was in place and readings recorded daily
- The PSTs were in a poor condition and there were no functional motors in place to drive the scum trap arm. This poses a risk to effective treatment as desludging is not optimal, as a result there are frequent blockages
- Both biofilters were in a poor condition- the arms were non-functional, nozzles were blocked and air release valves have failed resulting in severely uneven water distribution on the biofilters. Due to blockages one biofilter was out of operation. The pressure resulting from the blockages had resulted in overflow of raw sewage from the distribution box
- The inlet structure to the secondary settlers was severely corroded, with result that the bridge had no support left and presented a safety risk to walk on
- Final effluent is disinfected using HTH floaters, however chemical supply was reported to be erratic and unreliable
- The anaerobic digesters were not well maintained nor managed as frequent blockages were experienced. The turnaround time to unblock the lines were also noted to be excessive
- The sludge drying beds showed no evidence that sludge had been disposed of to the drying beds in recent times.



Grit removal is functional, but overloaded due to excessive grit entering the site



PSTs not operational - operators have to manually push scum trap arm; no motors to drive the arm



Ponds not well maintained, plant growth on structures, terrain reasonably well maintained on the terrain

4.10 North West Region

Water Service Institution	DPW North West	
Water Service Providers	Ascul Construction CC	
	WaterLab Services	
	Virtual Consulting Engineers	
	Magwa Construction	
Municipal Green Drop Score		VROOM Impression (Towards restoring functionality):
2021 Green Drop Score	18%↑	1. Pumpstation pumps and mechanical equipment
2013 Green Drop Score	0%	2. Maintenance and repairs defects
2009-11 Green Drop Score	NA	3. Primary settling tank ineffective
		4. Anaerobic digester
		5. Chemical Disinfection dysfunctional
		VROOM Estimate
		- R14,456,420

NA = Not Assessed/ Audited

Key Performance Area	Weight	Bray Port of Entry	Boshoek SAPS	Klipdrift MB	Losperfontein CS
A. Capacity Management	15%	77.5%	65.0%	20.0%	60.0%
B. Environmental Management	15%	42.5%	46.3%	20.0%	42.5%
C. Financial Management	20%	18.8%	0.0%	0.0%	0.0%
D. Technical Management	20%	30.0%	28.8%	20.0%	28.8%
E. Effluent & Sludge Compliance	30%	0.0%	12.8%	5.6%	20.9%
F. Bonus		7.5%	0.0%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	-25.0%	-25.0%
H. Disqualifiers		None	None	Notice	None
Green Drop Score (2021)		23%	21%	6%	22%
2013 Green Drop Score		0%	0%	0%	0%
2009-11 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	NI	NI	NI	NI
Design Capacity Utilisation (%)		NI	NI	NI	NI
Resource Discharged into		Molopo River	NI	NI	NI
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	Insufficient data set
Physical Compliance	%	No monitoring	Insufficient data set	No monitoring	Insufficient data set
Wastewater Risk Rating (CRR% of CRR_{max})		Bray Port of Entry	Boshoek SAPS	Klipdrift MB	Losperfontein CS
CRR (2011)	%	70.6%	70.6%	100.0%	64.7%
CRR (2013)	%	100.0%	100.0%	100.0%	100.0%
CRR (2021)	%	94.1%	94.1%	94.1%	94.1%

Key Performance Area	Weight	Molopo MB	Ramatlabama	Rooigrond CS
A. Capacity Management	15%	47.5%	78.0%	66.0%
B. Environmental Management	15%	42.5%	46.5%	42.0%
C. Financial Management	20%	0.0%	35.0%	0.0%
D. Technical Management	20%	8.8%	24.5%	24.5%
E. Effluent & Sludge Compliance	30%	5.6%	0.0%	9.0%
F. Bonus		0.0%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	-12.5%
H. Disqualifiers		None	None	Notice
Green Drop Score (2021)		11%	25%	20%
2013 Green Drop Score		0%	0%	0%

Key Performance Area	Weight	Molopo MB	Ramatlabama	Rooigrond CS
2009-11 Green Drop Score		NA	NA	NA
System Design Capacity	MI/d	0.7	0.2	0.4
Design Capacity Utilisation (%)		NI	NI	NI
Resource Discharged into		NI	NI	NI
Microbiological Compliance	%	Insufficient data set	No monitoring	Insufficient data set
Chemical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set
Physical Compliance	%	Insufficient data set	Insufficient data set	Insufficient data set
Wastewater Risk Rating (CRR% of CRR_{max})		Molopo MB	Ramatlabama	Rooigrond CS
CRR (2011)	%	58.8%	100.0%	70.6%
CRR (2013)	%	100.0%	100.0%	100.0%
CRR (2021)	%	94.1%	94.1%	94.1%

Key Performance Area	Weight	Swartkopfontein BC	Welgedend	Skilpad BC
A. Capacity Management	15%	80.0%	47.5%	72.5%
B. Environmental Management	15%	58.8%	42.5%	67.5%
C. Financial Management	20%	2.5%	0.0%	18.8%
D. Technical Management	20%	30.0%	30.0%	32.4%
E. Effluent & Sludge Compliance	30%	22.5%	5.6%	13.1%
F. Bonus		7.5%	0.0%	0.0%
G. Penalties		-25.0%	-25.0%	-25.0%
H. Disqualifiers		None	None	None
Green Drop Score (2021)		29%	15%	29%
2013 Green Drop Score		0%	0%	0%
2009-11 Green Drop Score		NA	NA	NA
System Design Capacity	MI/d	0.03	0.03	0.19
Design Capacity Utilisation (%)		NI	NI	26%
Resource Discharged into		NI	Mooi River	NI
Microbiological Compliance	%	Insufficient data set	No monitoring	Insufficient data set
Chemical Compliance	%	Insufficient data set	No monitoring	Insufficient data set
Physical Compliance	%	Insufficient data set	No monitoring	Insufficient data set
Wastewater Risk Rating (CRR% of CRR_{max})		Swartkopfontein BC	Welgedend	Skilpad BC
CRR (2011)	%	52.9%	64.7%	82.4%
CRR (2013)	%	100.0%	100.0%	100.0%
CRR (2021)	%	94.1%	94.1%	76.5%

Regulator's Comment:

The DPW North West Region participated with commitment and dedication throughout the Green Drop audit process. The participation of a service provider during the confirmation audit ensured the flow of additional information. The 2021 Green Drop score of 18% is a significant improvement on the 0% baseline of 2013. Despite this progress, wastewater services are still not on par with good practice or compliance, some of which can be attributed to the lack of documentation (evidence). The Regulator regrets that the special DPW project of 2017/18 did not come to fruition, as a lot of good work and IRIS training took place to get the DPW ready for the audit.

The NW Region is urged to pay particular attention to the update and implementation of the W₂RAP, which is a valuable basis from where to identify all gaps (risks) and systematically address each. Technical expertise is a root cause to be addressed, specifically pertaining to Plant Supervisors, Process Controllers, and DPW laboratory services, some of which are outsourced. Operations is erratic and often absent, and the laboratory does not have quality assurance systems in place.

Special attention must be given to the contractual requirements and oversight of any O&M work to ensure regulatory compliance. Maintenance teams are reported to be in place but is not effective, the TSA score of Losperfontein being proof of such.

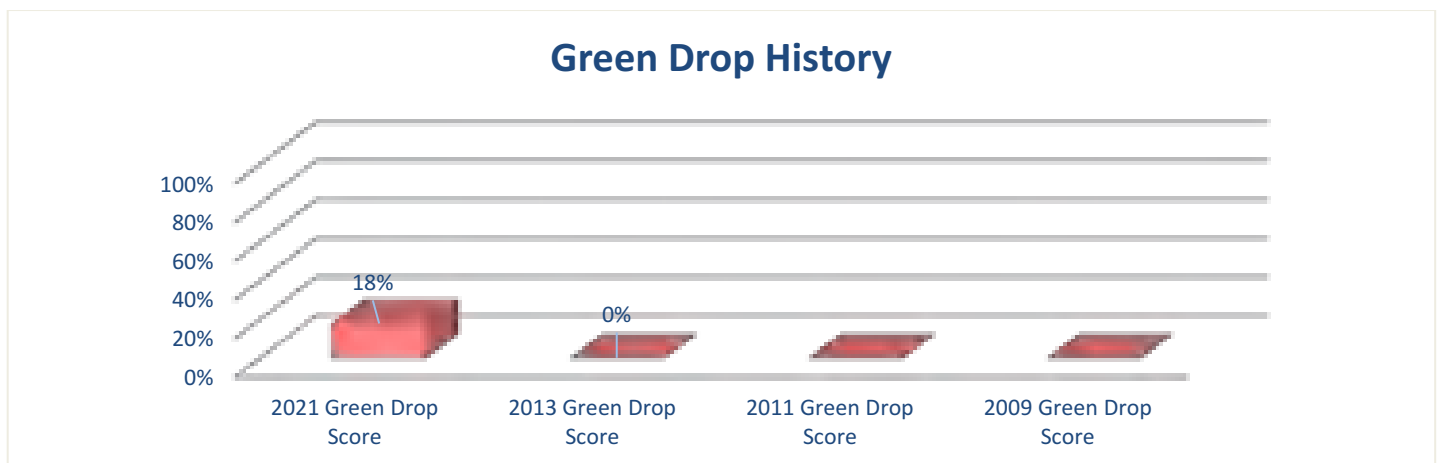
IRIS system upload is minimal for all systems and could be assigned to a dedicated laboratory or operational staff member to maintain. A number of “incomplete” actions is prompted on IRIS; these are low lying fruits to understand the competency gaps. The lack of operational and compliance monitoring, coupled with final effluent compliance, impacted severely on the overall audit score.

Positives include the presentation of very good asset registers (dated 2017), process audits and W₂RAPs (not implemented), and WWTW Classification Certificates. These high standards, combined with the energy and commitment of the regional team, bodes well for the upcoming 2023 audit. For 2021 however, the fact that all 10 systems are in critical state, compounded by all WWTWs in critical CRR risk positions except for one in high-risk position, places DPW North West on the regulatory enforcement priority list.

Green Drop Findings:

1. Most of the wastewater treatment plant certificates are uploaded, a commendable action
2. The Registration of Process Controllers and Supervisor is incomplete - DPW is urged to find a performance-based relationship with the PSPs to provide qualified Process Controllers and ensure the treatment facilities are regulatory compliant with Reg. 2834 or 813
3. Maintenance capacity is lacking in terms of planning, implementation, and qualified staff - DPW will benefit from a reassessment of the current model and associated SLA drafting and management to ensure that infrastructure and processes are professionally operated and maintained
4. Several of the systems have well developed and professional W₂RAP reports, however, these have not been officially signed off by the DPW officials nor implemented. The W₂RAP tool can be instrumental in embedding the principles and practice of risk management at regional level
5. Operational monitoring is one of the poorest areas in the services implementation, and possibly resonates the defects in structure and deployment of skilled staff at the facilities
6. Financial information was mostly absent for most systems with several improvement opportunities to present budgets, expenditure, and unit costs
7. Compliance monitoring, while implemented in some of the facilities, it is done to the expectation of the Regulator, averaged between 1 to 8 months of sampling routines, with samples not being done for all three quality categories, i.e. Microbiological, Chemical & Physical, as per Authorization requirement
8. Flow monitoring is mostly absent and triggered severe penalties that impacted on the Green Drop score. Many plants have flow meters in place, but its either not read, not interpreted or out of order (if not absent)
9. None of the ten plants are in critical risk positions and the remaining plant is in a high-risk position
10. No capital funds were reported to address the defects identified at any of the 10 systems.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Losperfontein WWTW 29%

The **Losperfontein WWTW** was inspected to verify the Green Drop audit findings:

- Two out of 2 pumps were not operational resulting in spillages on the treatment plant terrain. Spillages have not been cleaned up
- Poor maintenance regime and a run-to-failure philosophy result in deterioration of infrastructure
- A chicken farm has been erected next to the treatment facility utilising a pond system to treat resulting effluent and discharging the final effluent onto the Losperfontein WWTW. The co-existence of these two facilities must be investigated to ensure that no regulatory compromises is made viz their functionality
- Process Controllers were absent at the plant, which adversely affects the daily operations and maintenance, including information collection and analysis
- Flow & flow balancing record keeping was not done at the facility and reportedly has not been done for quite some time – this activity is critical toward effective the operation and future planning and should be re-introduced without further delay
- The PST was in a dire state as result of the pumps not functioning for over 3 months
- Sludge management was mostly absent at all process units. The turbid high-solids flow entering the biofilters was due to the PST sludge pumps being non-operational and sludge withdrawal not being effective
- The resultant sludge and outflow from the adjacent chicken farm adversely affects the functioning of the secondary clarifiers
- The chemical disinfection unit was in extremely poor condition, thus adversely affecting the final effluent quality - urgent intervention is required
- The anaerobic digestion system was dysfunctional, thereby reducing the capacity of the plant to treat sludge to a minimum. Cleaning of the system, and training to operate the technology would be good starting point to get the system functional.



Flow meter is in place and functional, but data is not interpreted and reported against design capacity



Settling of sewage is severely compromised by non-operational equipment and lack of process control



Anaerobic digesters for sludge treatment is not operational and sludge is spillage to the surrounding environment

4.11 Northern Cape Region

Water Service Institution	DPW Northern Cape	
Water Service Provider	DPW Northern Cape	
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):	
2021 Green Drop Score	6%↓	1. Primary Dortmund tanks to be desludge and re-commissioned
2013 Green Drop Score	18%	2. Primary sludge transfer pumping station electric and mechanical equipment to be reinstated
2009-11 Green Drop Score	NA	3. Biofilter to be re-commissioned
		4. Humus tanks to be re-commissioned
		5. Rapid gravity filters and Chlorine disinfection need to be re-instated
		VROOM Estimate:
		- R502,320

Key Performance Area	Weight	Lohatla MB	Louisvale MB	Middelputs PE	Nakop PE
A. Capacity Management	15%	36.0%	36.0%	56.0%	45.0%
B. Environmental Management	15%	0.0%	0.0%	0.0%	0.0%
C. Financial Management	20%	0.0%	0.0%	0.0%	0.0%
D. Technical Management	20%	9.5%	19.5%	19.5%	11.8%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%	0.0%	0.0%
F. Bonus		0.0%	0.0%	0.0%	0.0%
G. Penalties		0.0%	-25.0%	-5.0%	-5.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		5%	4%	10%	6%
2013 Green Drop Score		4%	4%	1%	29%
2009-11 Green Drop Score		NA	NA	NA	NA
Design Capacity	MI/d	0.82	0.26	0.01	0.022
Design Capacity Utilisation (%)		98%	38%	100%	100%
Resource Discharged into		No Discharge	No Discharge	Recycle	No Discharge
Microbiological Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR_{max})		Lohatla MB	Louisvale MB	Middelputs PE	Nakop PE
CRR (2011)		94.1%	94.1%	100.0%	100.0%
CRR (2013)		76.7%	100.0%	100.0%	100.0%
CRR (2021)		82.4%	70.6%	88.2%	88.2%

Key Performance Area	Weight	Olifantshoek RS	Vioolsdrift PE
A. Capacity Management	15%	36.0%	45.0%
B. Environmental Management	15%	0.0%	15.0%
C. Financial Management	20%	0.0%	0.0%
D. Technical Management	20%	19.5%	0.0%
E. Effluent & Sludge Compliance	30%	0.0%	0.0%
F. Bonus		0.0%	0.0%
G. Penalties		0.0%	-5.0%
H. Disqualifiers		None	None
Green Drop Score (2021)		7%	6%
2013 Green Drop Score		33%	39%
2009-11 Green Drop Score		NA	NA

Key Performance Area	Weight	Olifantshoek RS	Vioolsdrift PE
Design Capacity	MI/d	0.7	0.12
Design Capacity Utilisation (%)		86%	100%
Resource Discharged into		Land discharge	Conservancy Tank
Microbiological Compliance	%	No monitoring	No monitoring
Chemical Compliance	%	No monitoring	No monitoring
Physical Compliance	%	No monitoring	No monitoring
Wastewater Risk Rating (CRR% of CRR _{max})		Olifantshoek RS	Vioolsdrift PE
CRR (2011)		NA	NA
CRR (2013)		NA	NA
CRR (2021)		82.4%	88.2%

Regulator's Comment:

The DPW Northern Cape Region was ill prepared for the Green Drop audit, and lack evidence on fundamental aspects such as final effluent compliance, functional laboratory services, IRIS data, and operational knowledge. Despite the presentation of excellent process audits, O&M manuals, and sludge management plans, none of these were implemented or used to inform improvement strategies. As result, a 6% Green Drop score marks the 2021 performance of the Region.

A risk to be mitigated is the manner in which service provider contracts are structured, overseen, and monitored, specifically related to supervisory, operational and maintenance requirements. No performance measures are in place to safeguard final effluent or sludge quality. Maintenance, technical, and scientific capability will need to strengthen in pursuit of effluent quality that satisfied the legal stipulations.

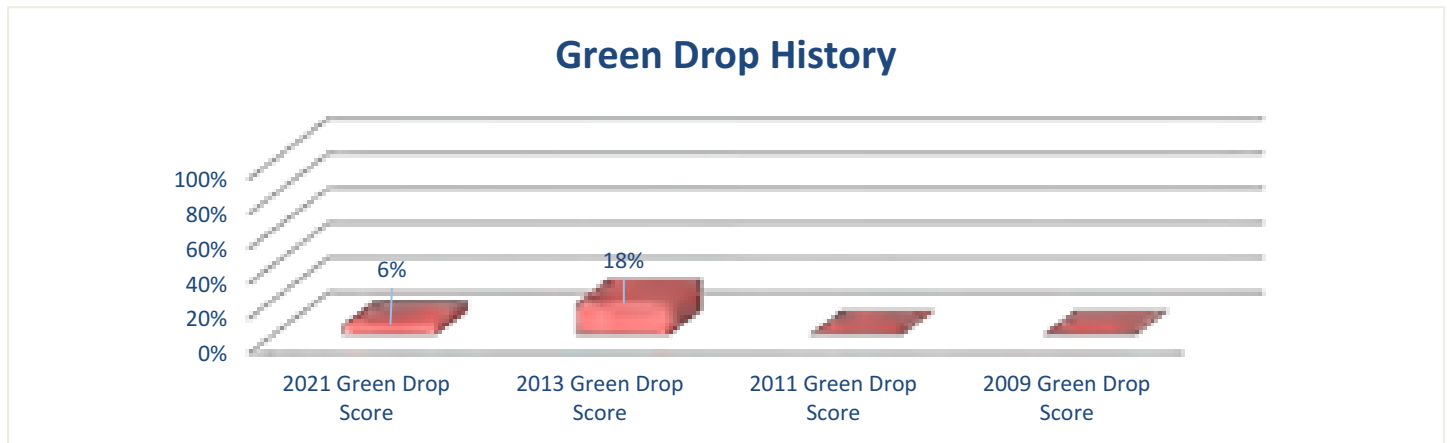
A number of improvement opportunities can be identified for the Region, starting with the revival, update and implementation of the 2017-18 reports and tools. The O&M contracts need to re-design to stipulate legislative compliance and industry good practice and need to be enforced by DPW project managers. Skills development in the operations and management of wastewater processes and infrastructure is key to further improvement. Commitment and oversight by senior management needs to be intensified. Credible data from the laboratory and field instrumentation is an eminent risk and need to be addressed via the W₂RAP process.

The National and regional DPW teams are encouraged to further develop and implement the W₂RAP process as an effective mechanism to reduce the CRR. Active identification, prioritisation and correction of higher risks will be a good and sustainable turnaround strategy.

Green Drop findings:

1. Process Controllers are not registered
2. No operational monitoring and compliance monitoring could be presented
3. Financial information was largely absent, including budgets and expenditure
4. Flow meters are in-place and flow recorded but no trend analysis is done
5. The treatment plant does not comply with effluent quality standards, thereby impacting negatively on the receiving environment and public health
6. None of the plants have a Water Use Authorisation and no compliance monitoring is taking place
7. The W₂RAP is not fully implemented and should be used to prioritise critical risks
8. Sludge should be classified, and a sludge monitoring plan should be developed and implemented.
9. All the plants are in high-risk positions
10. No capital projects is in place supported by business plans, however some projects were mentioned:
 - o R0.00: Middelputs PE – recycle effluent for toilets and non-domestic
 - o R0.00: Nakop PE - recycle effluent for toilets and non-domestic
 - o R0.00: Olifantshoek RS – No business plans were presented.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report. The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.

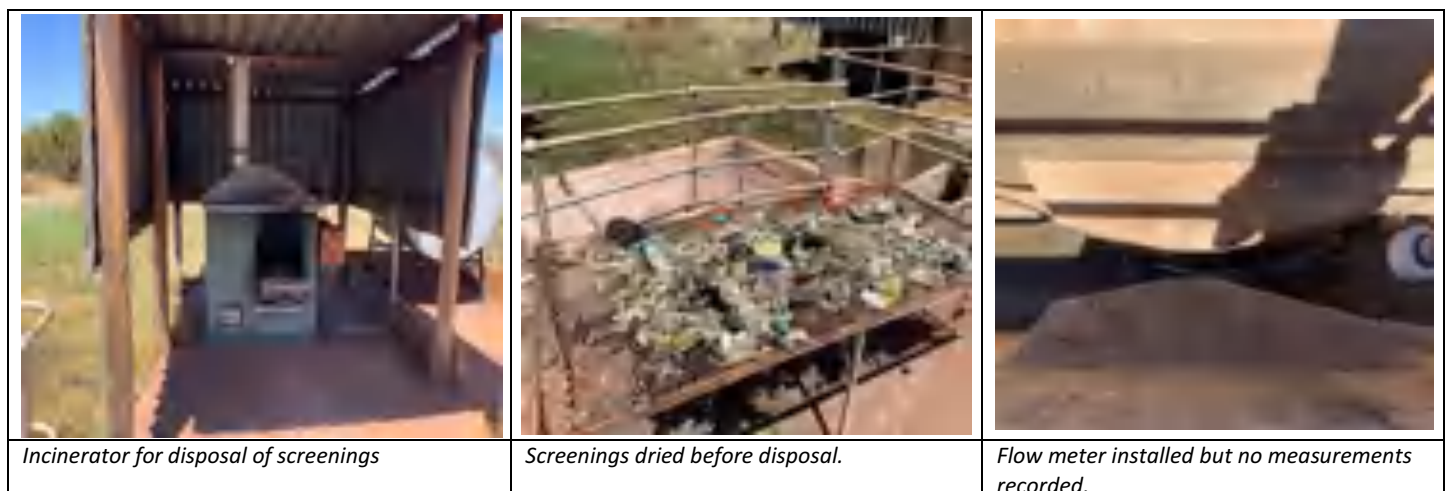


Technical Site Assessment

Lothala WWTW 26%

The **Lothala WWTW** was inspected to verify the Green Drop audit findings:

- The network and pump station was in good condition, with operations and maintenance attended to
- PFD and incident management protocols are displayed, but operational and maintenance logbooks were lacking
- No housekeeping or general upkeep of the site was performed. The terrain was not signposted nor fenced. Grass needed to be cut and general staff morale and satisfaction with work environment was low
- Flow meters were in place, however, no measurements were recorded nor interpreted for operation optimisation. No calibration certificates of meters were available. No raw sewage quality or extraneous flows were monitored
- Limited operational monitoring was done, and operational design limits of the process units were not known
- Desludging of settling tanks and clarifiers was inadequate and contribute to high solids carry-over to final effluent channels and high chlorine demand
- Biofilters were not functional as the entire process train was being bypassed, some structural defects in the biofilter walls
- Effluent discharged from the chlorine contact channels was being used as a conduit only
- The chlorine disinfection equipment was not operational
- Safety was not well attended to, protective clothing not available, BA kit, signage, and certificates of chlorine handling not available
- No sludge treatment and structures were in good condition. However, operational procedures and monitoring was not done for the anaerobic digesters
- Sludge drying beds were not being used, and no sand replacement plan was in place
- No sludge treatment as the sludge transfer pumps were not operational.



4.12 Western Cape Region

Water Service Institution	DPW Western Cape		
Water Service Provider	Overberg Water		
Municipal Green Drop Score	VROOM Impression (Towards restoring functionality):		
2021 Green Drop Score	22%↓	1. Sludge dry beds	
2013 Green Drop Score	42%	2. Sludge lagoons	
2009- 2011 Green Drop Score	NA	3. Grit removal	
		4. Flow metering.	
		VROOM Estimate:	
		- R15,759,000	

Key Performance Area	Weight	Voorberg Prison	Paardeberg Prison	Dwarsrivier Prison	Brandvlei Prison
A. Capacity Management	15%	30.0%	30.0%	38.0%	37.5%
B. Environmental Management	15%	59.0%	59.0%	59.0%	73.8%
C. Financial Management	20%	20.0%	20.0%	20.0%	0.0%
D. Technical Management	20%	25.0%	20.0%	23.0%	29.4%
E. Effluent & Sludge Compliance	30%	15.0%	15.0%	25.0%	18.8%
F. Bonus		0.0%	0,0%	0.0%	0.0%
G. Penalties		-75.0%	-25.0%	-37.5%	-50.0%
H. Disqualifiers		None	None	None	None
Green Drop Score (2021)		15%	21%	24%	20%
2013 Green Drop Score		53%	50%	52%	9%
2011 Green Drop Score		29%	14%	25%	32%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	1	0.102	0.09	1.23
Design Capacity Utilisation (%)		150%	NI	104%	151%
Resource Discharged into		Vier-en-Twintig River	Berg River	Breede River	Collection tank for irrigation
Microbiological Compliance	%	Insufficient data set	100%	89%	94%
Chemical Compliance	%	Insufficient data set	81%	56%	78%
Physical Compliance	%	Insufficient data set	96%	70%	69%
Wastewater Risk Rating (CRR% of CRR_{max})		Voorberg Prison	Paardeberg Prison	Dwarsrivier Prison	Brandvlei Prison
CRR (2011)	%	47.0%	59.0%	59.0%	65.0%
CRR (2013)	%	47.0%	41.0%	47.0%	71.0%
CRR (2021)	%	94.1%	76.5%	76.5%	64.7%

Key Performance Area	Weight	Buffeljagsrivier Prison	Drakenstein Prison	Helderstroom Prison	Saldanha Naval Military Academy
A. Capacity Management	15%	58.0%	38.0%	54.0%	54.0%
B. Environmental Management	15%	46.0%	63.0%	28.0%	28.0%
C. Financial Management	20%	0.0%	0.0%	1.6%	0.0%
D. Technical Management	20%	40.0%	20.0%	29.0%	20.0%
E. Effluent & Sludge Compliance	30%	74.0%	24.0%	35.0%	15.0%
F. Bonus		0.0%	0,0%	0,0%	0,0%
G. Penalties		0.0%	-25.0%	0.0%	-50.0%
H. Disqualifiers		None	None	None	None

Key Performance Area	Weight	Buffeljagsrivier Prison	Drakenstein Prison	Helderstroom Prison	Saldanha Naval Military Academy
Green Drop Score (2021)		37%	22%	28%	21%
2013 Green Drop Score		5%	5%	31%	14%
2011 Green Drop Score		55%	55%	45%	57%
2009 Green Drop Score		NA	NA	NA	NA
System Design Capacity	MI/d	0.25	3	2	1
Design Capacity Utilisation (%)		51%	51%	113%	63%
Resource Discharged into		Buffeljagsrivier	Buffeljagsrivier	Berg River	Sonderend River
Microbiological Compliance	%	100%	88%	88%	88%
Chemical Compliance	%	100%	84%	78%	87%
Physical Compliance	%	95%	75%	96%	54%
Wastewater Risk Rating (CRR% of CRR _{max})		Buffeljagsrivier Prison	Buffeljagsrivier Prison	Drakenstein Prison	Helderstroom Prison
CRR (2011)	%	82.0%	53.0%	53.0%	59.0%
CRR (2013)	%	59.0%	59.0%	59.0%	82.0%
CRR (2021)	%	47.1%	64.7%	64.7%	88.2%

Key Performance Area	Weight	Test Flight & Development Centre	Langebaanweg Air Force Base	Riebeeck West Prison
A. Capacity Management	15%	31.3%	30.0%	30.0%
B. Environmental Management	15%	73.8%	59.0%	59.0%
C. Financial Management	20%	0.0%	20.0%	20.0%
D. Technical Management	20%	23.5%	23.0%	20.0%
E. Effluent & Sludge Compliance	30%	18.8%	15.0%	15.0%
F. Bonus		0.0%	0,0%	0,0%
G. Penalties		-25.0%	-25.0%	-50.0%
H. Disqualifiers		None	None	None
Green Drop Score (2021)		21%	22%	17%
2013 Green Drop Score		17%	9%	15%
2011 Green Drop Score		31%	17%	40%
2009 Green Drop Score		NA	NA	NA
System Design Capacity	MI/d	0.078	0.58	0.97
Design Capacity Utilisation (%)		NI	36%	NI
Resource Discharged into		Evaporation ponds	Berg River, Sout River	Berg River
Microbiological Compliance	%	100%	75%	100%
Chemical Compliance	%	No monitoring	64%	100%
Physical Compliance	%	50%	67%	92%
Wastewater Risk Rating (CRR% of CRR _{max})		Test Flight & Development Centre	Langebaanweg Air Force Base	Riebeeck West Prison
CRR (2011)	%	71.0%	88.0%	65.0%
CRR (2013)	%	59.0%	59.0%	47.0%
CRR (2021)	%	88.2%	76.5%	58.8%

Regulator's Comment:

The DPW Western Cape Regional team for the 2021 Green Drop Audit included the main stakeholders for the wastewater treatment systems at DPW locations in the Western Cape (mostly prisons). Attending were the Green Drop Champion, the deputy director, facilities manager, engineering and laboratory technicians, operational personnel, and supervisors from Overberg Water, who is the appointed Water Service Provider. The Green Drop Champion was well prepared and presented an organised, indexed file with all relevant and available evidence.

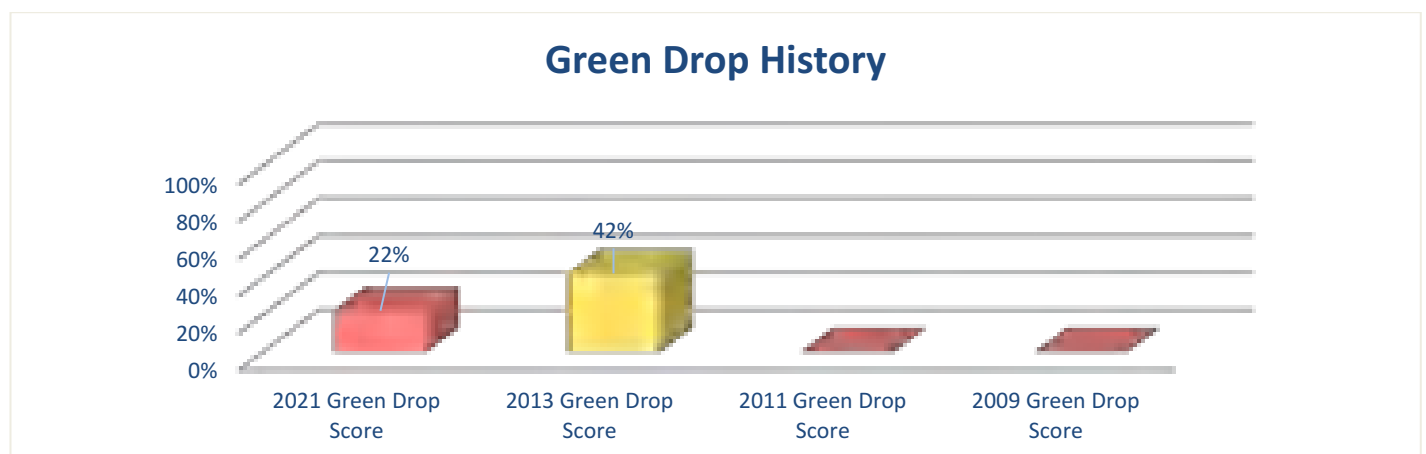
Most of the 11 treatment systems audited employed activated sludge processes with nutrient removal, but with a variety of process configurations. Green Drop 2021 scores for the WWTWs ranged from 14% to 37%, which were largely an improvement from the 2011 scores, but generally lower than the 2013 scores. The overall Green Drop 2021 score for DPW Western Cape was 22%. Despite the unconditional commitment by the technical section, there are a number of challenges which are restricting the attempts to better compliance in line with the Green Drop requirements. Firstly, is the multi-institutional nature of the wastewater service provision, consisting of the DPW, Department of Correctional Services (client) and Overberg Water (operating the WWTWs). Shortcomings in the contractual control (operations and maintenance contracts) lead to challenges with sustainable performance in the plants (e.g., a lack of effective operational monitoring, which was evident from the Drakenstein Prison TSA (score 50%). A further challenge is lack of technical capacity within the DPW to assist and support the Green Drop Champion and the water quality management functions. This needs to be addressed at executive level within the DPW.

DPW is lauded for the positive attitude in which they conducted the audit and their strive towards achieving high standards in the management of the 11 wastewater systems. The Regulator encourages the Western Cape Region to improve in those areas where the audit has revealed shortcomings, in particular the upload of the required documentation on IRIS. The Regulator is optimistic that the Region can attain much higher scores in the 2023 audit cycle, should the documents be in place, a full 12-month compliance monitoring cycle be completed and 12 months flow data available. The omission of the 3-4 months final effluent data were the predominant reason for not attaining score in excess of 40%.

Green Drop findings:

1. The WSI and operating service provider is striving towards improving their Green Drop compliance. This is done through on-the-job training of Process Controllers and putting more efficient report back systems in place
2. Compliance monitoring is done effectively and generally meets the requirements, although the restrictions of the recent pandemic have resulted in a forced scale-down of the sampling program at the time
3. The operational monitoring program lacks dedicated execution, but the purchase of new handheld and bench-scale meters, and training of the PCs to use them, promises to vastly improve the operational monitoring
4. Enforcing contractual obligations should go a long way towards improving contractual challenges
5. Aging systems are causing problems and should be renewed or refurbished where warranted and when funds are available
6. Of the 11 WWTWs, four are overloaded, 4 considered to be running at the design hydraulic capacity. The lack of flow measurement resulted in penalties applied. Three (3) plants was operating below the design hydraulic capacity.
7. None of the systems had updated W₂RAPs or process audits in place – this should be a key instrument to turnaround service delivery
8. Compliance of final effluent quality results were inconsistent, indicating non-optimised processes and failing mechanical and electrical systems from time to time
9. None of the plants attracted a score for final effluent quality, as result of incomplete monitoring data
10. None of the systems provided financial information. Management should be more involved in the budget and expenditure control functions (at least making inputs on a monthly basis).
11. One plant is in the critical risk position and five plants are in the high-risk positions
12. The laboratory at DPW head office in Cape Town is doing a good job in striving toward high standards in the water quality control.

The Regulator is concerned about the overall poor state of wastewater services at all systems and the consequential impact on respective water resources. It is thus required that the WSI submit a detailed corrective action plan within 60 days of publishing of this report (not needed for Buffelsjag River >30%). The plan must map the activities, responsible persons, timelines, and expected improvements as outlined in the Regulatory Comment. The plan will be considered against the Regulatory Comment and recommended for approval by a national regulation committee.



Technical Site Assessment

Drakenstein Prison WWTW 50%

The **Drakenstein Prison WWTW** was inspected to verify the Green Drop audit findings:

- The pump station building was found to be well secured, fenced and there was sufficient ventilation. However, there were no safety signs in place. The Piggery pumpstation is located within the Prison. One pump on duty and one pump on standby - both pumps were operational, however there were no records of downtime in place
- At the WWTW, the classification certificate, dated 2021/07/20, was available and displayed
- A maintenance and repair logbook was in place, but no information captured
- There is a Chlorine Colorimeter however it was not used because there were no reagents
- An incident management procedure was in place, but lacked contact details, and information was outdated
- The WWTW and surrounding area was tidy and well maintained, except around the drying beds. The audit team couldn't inspect the drying beds because of overgrown grass
- The workers were not satisfied with their workplace - no PPE (cleaning detergents, sanitizers, toilet paper) and have been working for the WSI for over 5 years and haven't been classified as Process Controllers yet
- The facility was well fenced and secured
- The grit channels were filled with grit and had not been cleaned in days
- Note about channels that should be cleaned regularly - one channel should be a bypass channel and not in permanent operation. The operation of the grit channels should be drastically improved
- An inflow meter was in place, but it has not been calibrated during the last 2 years
- There were dead zones observed, especially in the anoxic and some parts of the aeration basins because the mixers and three of the aerators were not operational
- Only 3 of the 6 aerators were operational, this is causing the sewage to be septic. Repair work was performed on one of the aerators during the inspection
- Disinfection was taking place with Calcium Hypochlorite.

		
<p><i>Screens and grit channels not cleaned</i></p>	<p><i>Site is tidy and evident of good groundskeeping</i></p>	<p><i>Sludge bulking and rising of the sludge blanket noticed which impacts on final effluent quality</i></p>

5. CONCLUSION

The National Green Drop Report 2022 provides recommendations and guidance for the way forward and can be access via the DWS homepage.

In summary, the way forward would entail sustainable improvement of the South African wastewater sector via:

The Department of Water and Sanitation as Regulator of the water sector will use this Green Drop Report as the performance baseline for the wastewater fraternity, to inform appropriate regulatory intervention with the objective to facilitate improvement. This will include the development of a Water Services Improvement Programme, which will include the 10-point plan towards informing sustainable intervention with the objective of ensuring a turnaround in the DPW Regions Water Services sector.

The results of this report demands that wastewater services be a primary focus area of the said programme in targeted areas. Green Drop Performance trends will be used to determine repetitive poor performance (which have led to significant environmental damage over a period of time), to inform a more drastic approach towards ensure turn around. This could include facilitating long term intervention by either a capacitated water board or any other suitable mode of sanitation services support.

National Government will ensure that grant funding allocated to the water sector will be allocated with the objective of restoring functionality of existing wastewater infrastructure according to the findings of this report. The determination of the very rough order of estimates (VROOM) was done to give an estimation of the capital requirement for the functionality restoration drive. This will be effected with the support from National Treasury.

The Regulator will improve the implementation of Section 19 of the National Water Act (Act 36 of 1998) to ensure that directives are issued with timeframes for implementation. Failure to respond will trigger remedial action be taken at cost of the non-complying entity. The Department will take steps to improve its capacity to more effective in this duty. There are engagements with the Department of Cooperative Governance as well as National Treasury to explore ways of utilising conditional grants for the purpose of remedial intervention.

The Department welcomes the participation of ESKOM, SASOL and other private sector partners in the Green Drop Process and will take guide from this to ensure that a more inclusive regulatory process be explored for the next audit season. The Green Drop Certification programme will thus become mandatory for all wastewater treatment systems, including the private sector.

Water Services Institutions are hereby encouraged to commence immediately with the preparation for the next Green Drop audit process.

For 2022, Green Drop awards and acknowledgement are attributed to the DPW Regions as follows:

“It always seems impossible until it’s done.”
Nelson Mandela

RECOGNITION OF TEAMS & INSTITUTIONS				
Awards - DPW	Criteria	Winner	2 nd runner up	3 rd runner up
Highest Scoring Region	%GD score - Region	DPW Eastern Cape PE (45%)	DPW Western Cape (22%); DPW Gauteng JHB (22%)	DPW Mpumalanga (21%)
Highest Scoring Systems	%GD score - system	Middeldrift Prison (55%), DPW Eastern Cape PE	Storms River Police Station (52%), DPW Eastern Cape PE	Kirkwood Prison (46%), DPW Eastern Cape PE
Highest Technical Site Assessment score	% TSA score	St Albans Prison (81%), DPW Eastern Cape PE		
Best Progress from 2013 - 2021	Highest % GD score increase 2013 - 2021	DPW Eastern Cape PE (8% to 45%)	DPW Gauteng Jhb (0% to 22%)	DPW North West (0% to 18%)
Best Regional Risk Managers	Lowest CRR% WSI	DPW Eastern Cape PE	DPW Mpumalanga	DPW Western Cape
Best Risk Positions	Lowest CRR systems	Middelstrift Prison, PE	Sandriver Military Base, Nelspruit ; Buffeljagsrivier Prison, Cape Town	Mahamba Port of Entry, Nelspruit

RECOGNITION OF INDIVIDUALS and GREEN DROP CHAMPIONS		
Recognition	Name and Designation	Award
DPW - Western Cape: All Systems	Ashia Petersen - Control Scientific Technician, Water Management	A motivated, enthusiastic wastewater professional with excellent technical know-how
DPW - Mpumalanga: All Systems	Puseletso Mohlala - Water and wastewater supervisor	A Green Drop expert and superb organiser - striving to keep IRIS and systems organised under challenging circumstances

Despite dysfunctional equipment at the DPW Barberton Correctional Services WWTP, the staff climbed through the safety railing in order to manually push the arms on the primary sedimentation tanks, understanding the importance of scum removal. The arms on the trickling filters were also not functional and in order to get some flow distribution and wetting of the whole filter area, staff manually moved these arms along. Remarkable. DPW management take note.



Despite several logistic and security challenges with this works on the Zimbabwean border, the service provider to DPW was able to keep the plant and surrounding at a high ergonomic standard and functional. This plant set the standard for what can be achieved by DPW irrespective challenges experienced.



Top: DPW team at the Drakenstein Correctional Services. A good audit attendance was observed – this team shows high promise.
Below: Devon Correctional Central – a friendly team, committed contractor, terrain is neat and well-kept signage of good standard. This plant has the potential to reach Green Drop Certification in 2023.



ANNEXURE A: CALCULATIONS TABLE

PARAMETER	DESCRIPTION	CALCULATION	REFERENCE
Green Drop Scores	A GD % is awarded to an individual WWTW based on audit results considered against 5 KPAs. The individual audit scores aggregate as a single (weighted) GD audit score for the WSI. The score is weighted against the design capacities of the individual WWTWs.	<p>1) System GD score (%) = Sum (Audit scores x KPA sub weights) for each of the 5 KPAs Example: KPA sub weight = 15% of 100% for all 5 KPAs; KPA A sub-weights are 20% each for sub-KPAs A1 to A5 as per GD Requirements in the scorecard $KPA A = (100\% \times 0.2) + (100\% \times 0.2) + (90\% \times 0.2) + (100\% \times 0.2) + (100\% \times 0.2) = 98\%$ Contribution of KPA A to the overall GD score = $(98\% \times 0.15) = 14.7\%$ (out of 15%)</p> <p>2) WSI GD score (%) = Sum ((System design capacity / Total design capacity) x System GD score) Example (WSA - 2 Systems): $WSA GD score = ((200 \text{ MI/d} / 255 \text{ MI/d}) \times 66.4\%) + ((55 \text{ MI/d} / 255 \text{ MI/d}) \times 86.6\%) = 70.7\%$</p>	Introductory Provincial and National Chapters
Cumulative Risk Rating	CRR and %CRR/CRRmax The CRR value is based on 4 (weighted) risk indicators, i.e. the design capacity, ADWF, # final effluent failures and technical skills status at each WWTW. The risk weights are summarised in the section following this table. The %CRR/CRRmax provides the variance of a CRR value against the maximum CRR value that could potentially be reached if all 4 risk indicators are in critical state	<p>1) $CRR = (A \times B) + C + D$ where A = Design capacity rating, B = Capacity exceedance rating, C = Final effluent failures rating, D = Technical skills rating Example: $CRR = (2 \times 3) + 6 + 2 = 14$; $CRR \text{ max} = (2 \times 5) + 8 + 4 = 22$; $\%CRR/CRRmax = (14/22) \times 100 = 63.6\%$</p> <p>2) $WSA \%CRR/CRRmax = \text{Mean (arithmetical average)}$ $\%CRR/CRRmax$ calculated for each WSA Example (3 systems): $WSA \%CRR/CRRmax = \text{Mean}(64.9\% + 40.6\% + 59.1\%) / 3 = 54.9\%$</p>	Introductory Provincial and National Chapters
Technical Site Assessments	The TSA % reflects the physical condition of the sewer collector network, pumping stations, treatment plant and point of discharge. The intention of the TSA is to verify the evidence and findings presented during the GD audit through the physical inspections of randomly selected sites	Multiple TSA scores per WSA: Combined TSA score = System design capacity divided by total TSA design capacity and multiplied by TSA score Example (2 TSA scores) = $(200 \text{ MI/d} / 350 \text{ MI/d}) \times 71\% + (150 \text{ MI/d} / 350 \text{ MI/d}) \times 59\% = 66\%$	GD scorecards
	TSA and GD score comparison	$\% \text{ Deviation (TSA \& GD score)} = \% \text{ score difference}$ Example: $TSA \text{ score} = 44\%$ and $GD \text{ score} = 38\% = 6\%$ deviation or difference	Diagnostic 6
Green Drop KPA Analysis	Mean GD score (&) for KPA A to E	$\text{Mean (arithmetical average)} = \text{Mean (Range of values)}$ Example: $\text{Mean } (32\% + 68\% + 94\%) / 3 = 65\%$	Diagnostic 1
Technical Competence	Ratios to do a comparative analysis “Qualified Technical Staff” - staff appointed in positions to support wastewater services, and who has the required qualifications. “Technical shortfall” means the number of staff who are in technical support positions. “Qualified Scientists” - professional registered scientists (SACNASP) appointed in positions to support wastewater services. “Scientist’s shortfall” means the number of scientists in scientific positions that are professional registered and qualified in technical support positions but not qualified. “Shortfall” is calculated based on a minimum requirement of at least 2 Engineers/Technologists/Technicians and at least one 1 Scientist per WSI.	Ratio - A : B (2 elements) or A : B : C (3 elements) etc Example 1: WWTW staff - No. Supervisors : No PC = 1 : 3 (based on 2 shifts) Example 2: If WSI has no qualified technical staff, the shortfall would be 2 qualified technical staff; Similarly, If WSI has 1 qualified technical staff, the shortfall would be 1 qualified technical staff Example 3: If WSI has no qualified scientific staff, the shortfall would be 1 qualified scientist; Similarly, If WSI has 1 qualified scientist, the shortfall would be zero	Diagnostic 2

PARAMETER	DESCRIPTION	CALCULATION	REFERENCE
Treatment Capacity	Future average wastewater flows (minimum and maximum options) based on future population growths using 2021 Statistical figure of 2.5%	Red Book: Water consumption (q) = 400 l/c/day; wastewater flow (qw) = 60-80% of water consumption. Anticipated flow Qw = P*q*qw (P-population) Example: 219.4 MI/d spare capacity. 40-60% goes to plant: 0.4*219.4-160l/c/d to 240 l/c/d; Available capacity can service: 219.4 x 1,000,000/160 = 1,371,250 persons (for 40% flow) and 219.4 x 1,000,000/240 = 914,166 persons (for 60% flow)	Diagnostic 3
Wastewater Monitoring and Compliance	%Mean of each of the 3 no. final effluent categories (Microbiological, Chemical and Physical)	1) Mean (arithmetical average) = Mean (Range of values) Example: Mean (24% + 71% + 91%) / 3 = 62% 2) % Compliance = #Compliant samples / Total #Samples tested *100 Example: %Compliance = 42 samples comply with 75mg/l COD / 50 samples tested = 84% compliance for COD	Diagnostic 4
Energy Efficiency	Median used for Actual SPC and Energy Cost (R/m ³) due to asymmetrical/ skewed data sets and because of outliers that do not represent credible figures or values	Median = +Median (Range of values) Example (Actual SPC in kWh/m ³): Median = (1.02 + 1418 + 0.51 + 0.36) = 0.77	Diagnostic 5
	Typical industry benchmark figures (range as per the wastewater technology types (effluent) per WSI) and Energy Unit Cost/Tariff (R/kWh) (From: WRC 2021 Energy Report)	Range = Range (A to B) or Range (A to C), etc Example (Industry benchmarks for type of WW technology in kWh/m ³) where WSI has Activated Sludge & BNR and Biofilters: Range (BF & AS BNR) = 0.177-0.412	
Operation & Maintenance & Refurbishment of Assets	O&M Cost Benchmarking using: - WRC WATCOST model: calculated breakdown of assets into civil, buildings, pipelines, mechanical, electrical, instrumentation. - SALGA model: calculate annual maintenance cost per asset type based on benchmark of 15.75% of asset value -Production cost by a specific WWTW to treat inflow expressed in R/m ³ -Shortfall is the gap between the budgeted production cost budgeted and actual cost expressed in R/m ³	1) Current asset value (100% = Civil structures (46%) + Buildings (3%) + Pipelines (6%) + Mechanical equipment (35%) + Electrical equipment (8%) + Instrumentation (2%) 2) Modified SALGA maintenance guideline: 15.5% = Civil structures (0.5%) + Buildings (1.5%) + Pipelines (0.75%) + Mechanical equipment (4%) + Electrical equipment (4%) + Instrumentation (5%) Example (Civil structures) = (0.46 x R20,000,000) X 0.005 = R46,000 3) System O&M cost = System Expenditure (R) / Operational Flow (MI/d) * 1000 Example: R13,1m / 9.6 MI/d *1000 = R1.36/m ³ 4) Shortfall = Budget Cost – Actual Cost Example: R3,90/m ³ - R1.36/m ³ = R2.54	Diagnostic 7
	Median used for O&M Budget (R/m ³), O&M Actual (R/m ³) and Shortfall (R/m ³) <i>Note: asymmetrical/skewed data sets, outliers, data credible issues</i>	Median = +Median (Range of values) Example: (O&M Budget (R/m ³)): Median = (2.03 + 13,476.00 + 6.98 + 7.77 + 3.67) = 6.98	
VROOM	Estimation of cost required to restore existing infrastructure to its original design capacity and operational functionality by addressing civil, mechanical, and electrical failures or defects. The cost is derived from an algorithm that uses the GD Inspector's impression of the condition of the hardware, coupled with the system-specific design capacity and GD score to derive an aggregated score for all systems within the WSI. The aggregated score is based on an algorithm that uses the refurbishment cost estimate of 1-2 systems and extrapolates it according to the other systems size and GD scores to arrive at a VROOM estimation cost	With reference to the earlier 'Technical Site Assessments' parameter: The following is extracted from the TSA scorecard and inserted into the WSA Summary Dashboard of the GD scorecard: (1) VROOM cost ratio in R million per MI/d (2) % cost estimates for Civil and Mechanical Estimated refurbishment requirement = VROOM cost ratio (R million per MI/d) x total WSA systems design capacity x 10 ⁶ Example: VROOM Cost = R1.87 (from TSA scorecard) x 1058 MI/d (Total design capacity from WSI Information Sheet) x 10 ⁶ = R1,978,460,000	GD scorecards Diagnostic 7

CRR Risk Weighting: Risk is defined and calculated by the following formulae:

Cumulative Risk Rating (CRR) = (A x B) + C + D

Where:

A = Hydraulic design capacity of the treatment plant in Ml/day

B = Operational flow as % of the installed design capacity

C = Number of non-compliant effluent quality parameters at point of discharge to receiving water body

D = Number of technical skills gaps (supervision, operation, maintenance) in terms of Reg. 2834 & Draft Reg. 813.

Each risk element carries a different weight in proportion to the severity of the risk element (refer to Annexure A):

A: Design Capacity (Ml/d)		WF
Design Capacity Rating	> 400	7
	201 to 400	6
	101 to 200	5
	51 to 100	4
	21 to 50	3
	20 to 5	2
	<5	1

B: Design Capacity Exceedance (%)		WF
Capacity Exceedance Rating	> 151 %	5
	101 - 150 %	4
	51 - 100 %	3
	1 - 50 %	2
	0 - 10 %	1
	< 0 %	0

C: Technical Skills Compliance		WF
Technical Skills Rating	Superintendent + Process Controllers + Maintenance Team	1
	Superintendent + Maintenance Team but no Process Controllers	2
	Process Controllers + Maintenance Team but no Superintendent	
	Process Controllers + Superintendent but no Maintenance Team	
	Superintendent but no Maintenance Team & no Process Controllers	3
	Process Controllers but no Maintenance Team & no Superintendent	
	Maintenance Team but no Superintendent & no Process Controllers	
	No Superintendent + No Process Controllers + No Maintenance Team	4

D: No of Non-Compliant Parameters	WF
Effluent Failure Rating	8
	7
	6
	5
	4
	3
	2
	1
	0

Risk indicator D for effluent quality (8x):

- Microbiological: Faecal coliform or *Escherichia coli*
- Physical: pH, EC, SS
- Chemical: COD, NH₃-N, NO₃-N, O-PO₄

ANNEXURE B: GUIDE TO READING THE REPORT CARD

The following is an example of a typical report card that appears in the Green Drop Report 2022. Results are provided in colour coded format – each colour has a specific meaning and performance reference.

Water Service Institution	Name
Water Service Provider/s	Name

WSI Green Drop Score	
2021 Green Drop Score	82%↑
2013 Green Drop Score	64%
2011 Green Drop Score	45%
2009 Green Drop Score	26%

The WSI Green Drop score is a **Performance Indicator** of the overall wastewater business of the organisation. See colour legends below. Arrows: Depict the current Green Drop status of the plant. A ↑ arrow shows improvement, ↓ shows digress, → shows unchanged situation

VROOM Impression: List of dysfunctional hardware VROOM Estimation: Extrapolated Rand value to restore functionality	Breakdown of VROOM		
	Civil	0%	RO
	Mechanical	71%	R4,270,280
	Electrical	29%	R1,769,720

Estimated refurbishment cost and key hardware defects are listed. The VROOM breakdown is summarised in the Provincial Summary under the 'Cost Diagnostic'.

Key Performance Area	Weight	System X
A. Capacity Management	15%	100%
B. Environmental Management	15%	86%
C. Financial Management	30%	72%
D. Technical Management	20%	76%
E. Effluent & Sludge Compliance	30%	70%
F. Bonus		78%
G. Penalties		0%
H. Disqualifiers		None
Green Drop Score (2021)		82%
2013 Green Drop Score		64%
2011 Green Drop Score		45%
2009 Green Drop Score		26%
System Design Capacity	MI/d	28
Design Capacity Utilisation (%)		77%
Resource Discharged into		Mhlongo River
Microbiological Compliance	%	91%
Chemical Compliance	%	96%
Physical Compliance	%	100%
Wastewater Risk Rating (CRR% of CRR_{max})		System X
CRR (2011)	%	76%
CRR (2013)	%	63%
CRR (2021)	%	45%

Colour codes	Appropriate action by institution
90-100%	Excellent situation, need to maintain via continued improvement
80-<90%	Good status, improve where gaps identified to shift to 'excellent'
50-<80%	Average performance, ample room for improvement
31-<50%	Very poor performance, need targeted turnaround interventions
0-<31%	Critical state, need urgent intervention for all aspects of the wastewater services business

A system is disqualified from GD Certification if it defaulted to respond to a Notice/Directive

The final Green Drop score - same colour legends as above

Operational flow as calculated as % of the design capacity (ADWF)*

Effluent quality compliance compared to mandatory limits as audited under KPA E. A system is disqualified from Green Drop Certification if microbiological and/or chemical compliance <90%

CRR% indicates the risk of each treatment plant. A higher value reflects a high-risk state (undesirable). A lower value reflects a lower risk state.

Note: Design capacity refers to Average Dry Weather Flow (ADWF)

CRR% Deviation	Risk Level	Colour
90 – 100%	Critical risk WWTP	Red
70 - <90%	High Risk WWTP	Yellow
50-<70%	Medium risk WWTP	Grey
<50%	Low Risk WWTP	Green

ANNEXURE C: ACRONYMS

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
AD	Anaerobic Digester	NI	No information
ADWF	Average Dry Weather Flow	NO ₂ /NO ₃	Nitrites/Nitrates
AS (P or R)	Activated Sludge (Plant or Reactor)	NMR	No Monitoring Required
BF	Biofilter	NQF	National Qualifications Framework
BNR	Biological Nutrient Reactor	O&M (&R)	Operation and Maintenance (and Repairs)
CCT	Chlorine Contact Tank	OHS	Occupational Health and Safety
CFO / CEO	Chief Financial / Executive Officer	PA	Process Audit
CHP	Combined Heat and Power	PC	Process Controller
C:N:P	Carbon Nitrogen Phosphorus ratio	PFD	Process Flow Diagram
CO ₂ eq	Carbon Dioxide equivalent	PO ₄	Ortho-phosphate
COD	Chemical Oxygen Demand	PoE	Port of Entry
COGTA	Cooperative Governance and Traditional Affairs	PPE	Personal Protective Equipment
CRR	Cumulative Risk Rating	PS	Pump Station
CS	Correctional Services	PSP	Private Services Provider
DAF	Diffused Air Flotation	PST	Primary Settling Tank
DBSA	Development Bank of South Africa	PTS	Participatory Testing Scheme
DCS	Department of Correctional Services	RAS	Return Activated Sludge
DO	Dissolved Oxygen	RBC	Rotating Biological Contactor
DPW	Department of Public Works	RBIG	Regional Bulk Infrastructure Grant
DWS	Department of Water and Sanitation	RR	Risk Register
EA	Extended Aeration	SABS	South African Bureau of Standards
EC	Electrical Conductivity	SACNASP	South African Council for Natural Scientific Professions
EPWP	Expanded Public Works Programme	SALGA	South African Local Government Association
FE	Final Effluent	SAP	Systems, Applications and Products
FeCl ₃	Ferric Chloride	SAPS	South African Police Service
GA	General Authorisation	SBR	Sequence Batch Reactor
GD	Green Drop	SCADA	Supervisory Control and Data Acquisition
GDC	Green Drop Certification	SLA	Service Level Agreement
GDIP	Green Drop Implementation Plan	SMP	Sludge Management Plan
GWSA	Green Water Services Audit	SPC	Specific Power Consumption
HTH	High Test Hypochlorite	SS	Suspended Solids
IMP	Incident Management Protocol	SSC/SST	Secondary Sludge Clarifier / Settler
IRIS	Integrated Regulatory Information System	SVI	Sludge Volume Index
IT	Information Technology	TSA	Technical Site Assessment
KPA / I	Key Performance Area / Indicator	USDG	Urban Settlements Development Grant
kl	kilo litre	VROOM	Very Rough Order of Measurement
km	kilo metre	W ₂ RAP	Wastewater Risk Abatement Plan
kWh	kilo Watt hour	WAS	Waste Activated Sludge
MA	Mechanical Aeration	WCDM	Water Conservation Demand Management
MB	Military Base	WF	Weighting Factor
MBR	Membrane Biological Reactor	WISA	Water Institute of South Africa
MCC	Motor Control Centre	WRC	Water Research Commission
MEC	Member of the Executive Council	WSA	Water Services Authority
MI	Mega litre	WSP	Water Services Provider
MI/d	Mega litres per day	WSI	Water Services Institution
MLSS	Mixed Liquor Suspended Solids	WSIG	Water Services Infrastructure Grant
NA	Not Assessed or Not Applied	WUL	Water Use Licence
NH ₃	Ammonia	WWTP/W	Wastewater Treatment Plant/Works
DPW Regions:			
EC	Eastern Cape (Mthatha and Port Elizabeth)	NW	North West
FS	Free State	NC	Northern Cape
GP	Gauteng (Johannesburg and Pretoria)	KZN	KwaZulu Natal (North and South)

LP	Limpopo	WC	Western Cape
MP	Mpumalanga		

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