WATER RESEARCH COMMISSION

WORKING PAPER

Towards establishment of the Brown Drop – A Regulatory Platform in Managing Excreta Flows in South Africa

by
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ABSTRACT

The maintenance of sanitation infrastructure, sewered and non-sewered, remains a cause of concern and a hinderance to achieving universal sanitation coverage. The lack of planning and management tools, specifically in the non-sewered domain, has led to unintended and unfortunate consequences of dilapidated infrastructure and incidents of unhygienic and dangerous user conditions. While regulatory mechanisms are available for sewered systems via the Green Drop certification process, there is no such complementary mechanism for non-sewered sanitation systems, despite nearly 30% of South Africans served by such facilities. Recognising the gap, the Water Research Commission (WRC) introduced Shit Flow Diagrams (SFDs) to the South African water sector to assist municipalities understand the fate of excreta through the sanitation value chain. SFDs include both sewered and non-sewered systems. Municipalities have indicated the usefulness and benefits of SFDs in their sanitation planning. There exists a need to extend SFDs nationally through all provinces, local governments, and municipalities. The specific strategy envisaged to achieve critical mass of SFD roll-out is through the establishment of a Knowledge and Support Network comprised of tertiary education nodes established in different geolocations of the country that will provide continuous SFD reporting that will form the basis of the Brown Drop regulation. This paper presents an outline of the strategy and the partnership arrangements required to bring Brown Drop certification into fruition.

INTRODUCTION

Like many developing countries, South Africa is not characterised by uniform levels of sanitation services due to several factors largely associated with the historical legacy of apartheid planning, affordability and poverty. To ensure that there is uniform sanitation coverage, Government strategies ensures that at least the basic minimum access is afforded to its population, usually in the form of *Ventilated Improved Pit* (VIP) latrines and where there is payment for services, higher levels of services in the form of waterborne sanitation is provided. To date the coverage of sanitation is as follows:

- Total number of households covered by sewer-based sanitation is 65%
- Total number of households covered by septic tanks is 3%
- Total number of households covered by VIPs is 7%
- Total number of households covered by latrines without ventilation is 17%
- Total number of households without any sanitation is 4%

While waterborne systems are guided by formal regulations, bylaws and legislation ensuring that public and environment health is preserved, non-sewered systems get completely ignored. In undertaken through the WRC, many VIP latrines have been built with permanent superstructures, with little thought placed on servicing, maintenance and operation to keep infrastructure in any usable and hygienic state. Field experience in South Africa has raised the following concerns[1,2,3,4]:

- Pits are filling up much faster than their design life
- A variety of undesirable non-degradable objects are introduced into pits which may complicate pit emptying servicing
- Emptying of pit contents poses significant health risks and organisational difficulties.
- Poor construction results in problems with structural integrity, flies and odours
- Grey water is frequently added to the pit as there is no other mode of disposal, under certain circumstances this can lead to groundwater pollution
- There is a tendency to use pits for the disposal of household waste, much of which is non-biodegradeable
- Despite education programmes which strongly advise against this, many users are in the habit of dosing their pits with disinfectants to reduce odours and poison such as sheep dip to reduce fly breeding
- There is a lack of the necessary anaerobic activity in the pit or break down in the material

The implications of these developments are profound and have a huge impact on the sustainability of the technology and sanitation in general:

- Shorter lifespans mean an increase in maintenance costs should the desludging of pits be required. This is expensive and becomes very difficult if the pits and superstructures are not designed to allow for desludging
- Should desludging prove difficult, then the other option is to build new VIPs, which is expensive and contributes to the sanitation backlog

THE SANITATION TIME-BOMB

The maintenance of non-sewered sanitation facilities remains an on-going challenge within South Africa. The *Water Research Commission* (WRC) and its partners have produced scientific evidence which have highlighted the challenges with regular servicing of non-sewered sanitation technologies. Non-sewered sanitation have a limited filling capacity and require regular emptying, the cycle of which is dependent on the number of usages and containment unit of the facility. Contrary to what was initially hypothesized, dry latrines – a type of non-sewered sanitation technology that has been implemented throughout South Africa as an alternative to flushing toilets – have been shown to fill-up within 5-year cycles at household levels[1]. The sludge is largely unbiodegradable and contain various

volumes of detritus that limits the usage lifespan of the system[1,2]. In public environments, such as schools, these systems can fill up rapidly[3]. Research undertaken by the WRC and partners have shown that there is limited planning and technical capacity to deal with full latrines and the subsequent disposal of faecal sludges – sludges generated by non-sewered technologies[1,2]. These challenges point to a gap in planning and management system for the non-sewered sanitation domain. The gap has led to unintended and unfortunate consequences, including, dilapidated infrastructure beyond normal operation and maintenance procedures, full and overflowing latrines, stockpiling of sludges, and safety concerns, especially for children, and reinvestment in replacing dilapidated infrastructure which could have been avoided if there was regular servicing systems in place[1234]. A crescendo was reached after the unfortunate incidents of children falling and subsequently drowning in dilapidated latrines.

This gap in planning and technical capacity to deal with non-sewered sanitation remains a hinderance to the national development targets as it can result in a vicious cycle of continuous infrastructure investment due to lack of servicing and maintenance and poor user behaviour. A planning and management system is required and necessary to assist municipalities to deal with the non-sewered environment. The non-sewered environment cannot be overlooked; there are very little municipalities that do have non-sewered sanitation technologies within their boundaries.

While regulatory mechanisms are available for water and wastewater systems, through the Blue and Green Drop programmes respectively, there is no existing regulatory mechanism for non-sewered sanitation facilities. Further, there are challenges associated with the management of sludges from both sewered and non-sewered sanitation systems and there is very little collation of data that indicates how much of the sanitation sludge is safely managed.

LACK OF INFRASTRUCTURE AUDITING & EXCRETA MANAGEMENT

In 2018, the Presidency announced the SAFE (*Sanitation Appropriate for Education*) initiative to ensure that every school in the country has safe and appropriate sanitation facilities[5]. This was in direct response to a learner drowning in a dilapidated school latrine; not the first time an unfortunate incident like this has occurred. An infrastructure audit of school sanitation facilities was requested through the SAFE initiative to determine the status of school sanitation infrastructure, including decommissioned ones, with emphasis on non-sewered sanitation technologies. While this has been completed, the time delay to undertake the task – which often required data collection from rural geolocations – highlighted the need to have a regular infrastructure reporting system in place for non-sewered sanitation technologies[67]. The rural school sanitation environment is not too dissimilar to the rural household sanitation environment with regards to access to readily-available date on the state of non-sewered infrastructure, understanding servicing and maintenance intervals, etc. Non-sewered sanitation facilities can deteriorate to the point beyond normal operation within a short period (less than 2-5 years) without regular servicing in place and ultimately requiring new capital investment to replace dilapidated infrastructure. The issues point to a lack of planning strategies and technical capacity to deal with non-sewered sanitation facilities.

RESEARCH AND INNOVATION TO TACKLE THE CHALLENGE

Research undertaken through the WRC in the early 2010s was focused largely on alleviating the challenges associated with full latrines. This required understanding the mechanisms behind latrine filling and developing appropriate tools for the emptying and disposal of faecal sludge. The strategy was appropriate at the time due to the large number of full latrines and lack of know-how on how to effectively deal with accumulating faecal sludges[3,4]. At the centre of the challenge, the lack of appropriate planning and regular servicing remains an Achilles heel for the sanitation sector, for both the sewered and non-sewered domains.

Due to the challenges associated with current sanitation interventions, a range of programmes have been initiated to stimulate a new sanitation paradigm under the umbrella of the *Sanitation Transformation Initiative* (SANITI) which aims to tackle the technical, policy and regulatory challenges associated with current interventions through evidence-based research, stimulating research and development into alternative solutions, applying circular economy principles in sanitation and developing the technical capacity for new sanitation. The *South African Sanitation Technology Enterprise Programme* (SASTEP) is a programme under SANITI which aims to drive commercialisation and industrialisation of new sanitation that seeks to eliminate sludge production, produce desirable toilets, and reduce requirements for water and energy.

MOVE TOWARDS REGULATION AND MONITORING

The Green Drop certification process has been available for the wastewater sector since 2008. The incentive-based regulation approach measures and compares the results of the performance of Water Service Authorities and their providers via a standardised scorecard. Municipalities within Water Service Authorities and their providers are subsequently rewarded – or penalised – based on evidence of their success according to the minimum standards or requirements that have been defined. Municipalities achieve Green Drop status when they achieve scores of 90% or higher against pre-defined assessment requirements. Using an incentive-based approach, the introduction of competitiveness amongst the municipalities and using benchmarking in a market where competition is difficult to implement adds pressure to poorly or mediocre performing to achieve minimum standards. The Green Drop certification process merges wastewater operations, management and regulation where the focus is on the effective management of wastewater services instead of end-point monitoring and subsequent reactive operations[8]. Currently, there is no such existing regulatory mechanism for non-sewered systems and these systems are ignored in planning and management operations.

Recognising the gap, the WRC in 2018 initiated a research study – WRC no. K5/2813 – that aimed to introduce the water sector to *Shit Flow Diagrams* or Excreta Flow Diagrams – known globally under the acronym SFDs – and determine its suitability, applicability and usefulness for sanitation planning in South Africa. SFDs are visual representations of how faecal waste is managed across the sanitation value chain from containment until disposal. Data across the sanitation value chain is collected and collated to generate a graphic – known as a SFD (**Figure 1**). From the graphic, which shows faecal waste flow pathways and using colour coding to illustrate the percentage that is safely or not safely managed, areas for prioritisation or concern can be easily seen along the sanitation value chain. It therefore provides the full picture of how sanitation waste is being handled in a specific town, city or location. Depending on geolocation, the SFD can incorporate sewered and non-sewered technologies to provide an understanding of the sanitation supply chain within a city / town.

The SFD tool was developed in 2012/13 through the World Bank's Water and Sanitation Programme (WSP) when they carried out an analysis of excreta management in 12 cities. Since then, through funding support from the Bill & Melinda Gates Foundation, the SFD tool was refined and rolled out to various countries and a web portal developed – Home (susana.org) – to collate SFD reports and provide assistance with SFD development and reporting under the banner of the SFD *Promotion Initiative* (PI). The next phase of the SFD PI is to bridge the existing gap in data availability for monitoring safely managed sanitation and linking this to the *Joint Monitoring Programme* (JMP) reporting as part of Sustainable Development Goal Target 6.2.

In South Africa, the purpose of the WRC introducing SFD reporting was to assist with sanitation planning with the vision to catalyse the establishment of a *Brown Drop* certification programme for non-sewered sanitation systems. Eight (8) SFD reports were produced through the WRC-funded

initiative initiated in 2018. The outcomes of the research project in South Africa are discussed in the next section.

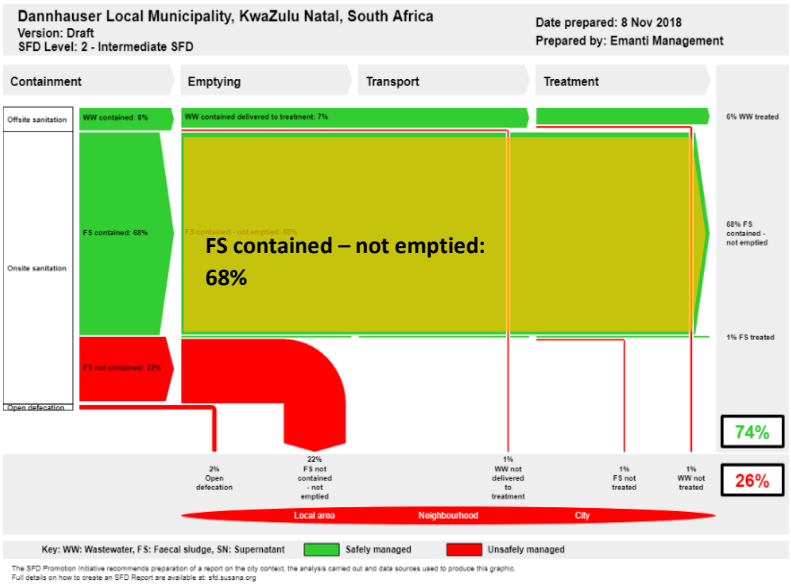

Figure 1. An example of a SFD. Green arrows show safely managed sanitation. Red show areas of concern.

INTRODUCING SFDs IN SOUTH AFRCA

To assist with improving the understanding of the sanitation situation and challenges faced/improvement actions required, the WRC funded the development of SFDs in South Africa with international and local partners and to support the establishment of regional capacity within South Africa to prepare high-quality SFDs.

Through the development of municipal SFDs and feedback from those that municipalities that contributed, municipalities were able to better understand their current sanitation situation. The benefit of the SFD tool in its diagrammatic form is that it highlighted areas where there are challenges along the sanitation value chain and which aspects being handled well – or where more priority is needed. In its easy-to-interpret format, it allows multiple skill-level stakeholders, including political leaders, municipal officials, sanitation experts and civil society organizations to understand the current sanitation situation across the value chain which could be used to support decision-making regarding sanitation planning and programming.

Through workshops and associated interactions with municipalities to familiarise the SFD concept, participants indicated that SFDs could be successfully used as a planning and advocacy/awareness tool within South Africa due to the ease of interpretation which would allow effective communication of challenges. It was also confirmed that SFDs will greatly assist Water Service Institutions in helping guide decision-makers when developing required strategies and plans and if more municipalities within each region could have SFDs developed, an overall regional sanitation status could be developed or even a national status. Without this data, the risk of sanitation management failures and associated poor outcomes are high. A key need highlighted by municipalities was the development of remedial action plans that could assist in managing challenges which were highted through the SFDs.

EXPANDING THE SFD NATIONALLY – BUILDING TOWARDS BROWN DROP REGULATION

As previously discussed, the *Department of Water and Sanitation* (DWS) has the *Blue Drop* certification programme for water service providers and their drinking-water supply systems and the *Green Drop* certification programme for wastewater systems. There is no equivalent regulatory mechanism for the non-sewered sanitation domain. This gap unintentionally excludes a significant proportion of the serviced population. As previously discussed, the lack of monitoring and regulatory mechanism had led to the unintended consequences of full unusable latrines and dilapidation of infrastructure. The WRC provided stimulus to provide a mechanism for planning around the sanitation value chain by introducing the SFD concept to South Africa and gauging feedback from users on the benefits of the tool.

The WRC aims to achieve critical mass of SFD reporting, close the knowledge-practice for SFD reporting and facilitate the buy-in of the SFD as a regulatory mechanism – *Brown Drop*. The SFD-South Africa (SFD-SA) strategy aims to provide the framework for SFDs to be included as a complementary mechanism to Blue and Green Drop certification. In order to facilitate critical mass for developing SFDs, the WRC and its partners seeks to catalyse the establishment of a **Training and Knowledge Support Network** that consist of multiple tertiary institutions to facilitate skills uptake and knowledge transfer of SFDs nationally. The process will involve understanding the methodological approach to SFD development and provide necessary skills and tools to students / regulators / municipal officials to develop SFDs. The strategy to utilise tertiary institutions as part of the **Training and Knowledge Support Network** was devised to provide continuous data collection and have SFDs incorporated as a tertiary education module for which can account for learning activities relevant to the water sector.

SFD-SA Strategy

The WRC intends to have SFD reporting achieve critical mass through the establishment of a **Training and Knowledge Support Network**. The WRC investment is intended to catalyse seed funding for the **Training and Knowledge Support Network** for SFD reporting that becomes self-sustaining and no longer needs additional WRC investment to remain economically viable (**Figure 2**). There are a number of key inter-connected objectives that need to be achieved through the WRC funding. This includes the following:

- **Establishment of a Training and Knowledge Support Network**: The tertiary education nodes in the network will become the authoritative leaders in SFD development, skills transfer, reporting and data management. This will include setting up a SFD Helpdesk, facilitate skills diffusion through a *Training of Trainers* (ToT) model, assessment and quality control of SFD reporting, and nurturing mutually-benefiting strategic partnerships that will allow for uptake of SFDs as a regulatory mechanism. The sustainability of the nodes within **Training and Knowledge Support Network** is dependent on the applied business model that will ensure it is self-sustaining and not dependent on additional WRC funding.
- **Trainer of Trainers (ToT) model**: The ToT model approach will be used to strengthen capacity building for SFD reporting. This typically involves highly-skilled personnel who are specialised in SFD development with capacity building typically in the form of peer-to-peer support through training and mentoring. The ToT model will be applied through tertiary education sectors and through organised peer-to-peer support media. The ToT can be a strong predictor of sustainability due to its potential for upskilling the workforce rapidly, economically and exponentially by developing a local base of trainers.
- **Quality control**: Through workshops and electronic media, including the SFD Helpdesk, SFDs will be developed according to the quality control procedures of the SFD Global Initiative. This will ensure that SFDs for the country are developed and assessed to a specific standard for reporting purposes.

- **Facilitate accreditation of SFD course**: The nodes in the **Training and Knowledge Support Network** will be responsible for curriculum development, content and learning materials that are aligned to unit standards and/or qualifications. Through the nodes of the **Training and Knowledge Support Network**, suitably qualified staff (trainers and assessors) will ensure that learners have access to adequate learning support services, e.g. online media videos and the SFD Helpdesk. It is envisaged that the nodes within **Training and Knowledge Support Network** will foster and nurture partnership with EWSETA to ensure that learning and assessment material are aligned to accreditation objectives.
- **Partnerships**: To achieve critical mass, partnerships that are based on technical capacities of the partner organizations or an organization having similar agenda are encouraged for the co-production of knowledge products and dissemination activities and joint advocacy opportunities that are aligned to the uptake of SFD reporting as part of regulatory mechanism.

The strategy for upscaling SFD development and reporting through various partnerships can be summarised in **Figure 2**.

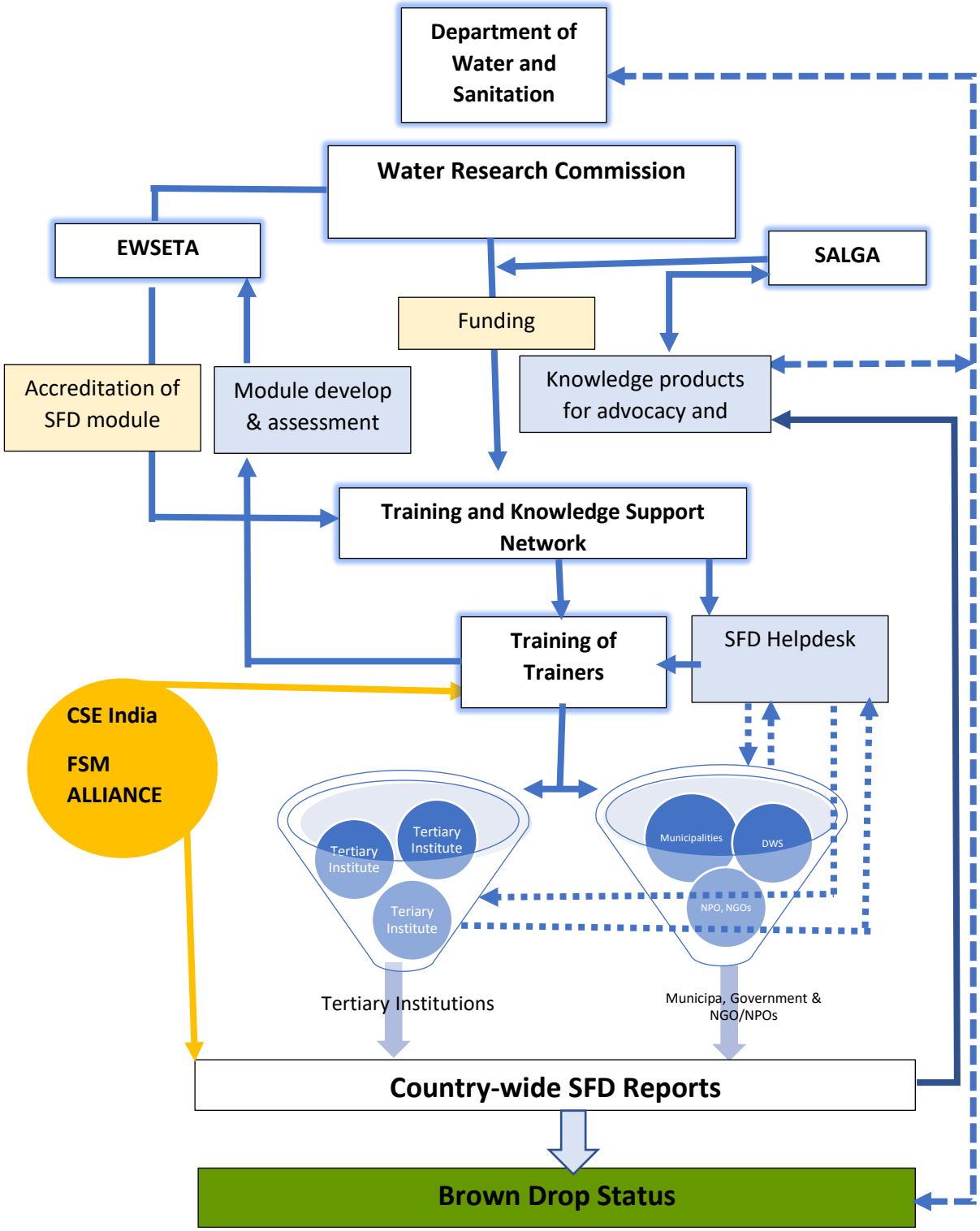

Figure 2. Strategy to facilitate critical mass of SFD reporting.

ROLES AND RESPONSIBILITIES AS PART OF SFD-SA STRATEGY

This section provides clarity, alignment, and expectations of those involved in the SFD strategy and outlines the required communications between the various institutions / groups. These key institutions should be involved and participate in various structures at local, provincial and national level to contribute to the scaling up of SFDs towards Brown Drop regulation:

- **Department of Water and Sanitation (DWS)**: The mandate of the DWS includes the regulation of the sanitation sector in the country, the provision of macro planning, regional bulk services and monitoring. This requires capacity to establish national policy guidelines, sanitation strategy, and authorisation of waste discharge, formulation of state subsidies, the development and enforcement of regulations, setting of minimum services standards and monitoring and regulating sanitation services. The DWS is expected to utilise the SFD reporting data from the **Training and Knowledge Support Network** as a means of sanitation planning and monitoring towards Brown Drop regulation. Joint advocacy and collaboration with the synthesis and updating of SFD reports with the **Training and Knowledge Support Network** will enable the formulation of the Brown Drop certification programme.
- **Water Research Commission (WRC)**: The WRC has previously facilitated the development of SFD reports in South Africa. Funding has been allocated by the WRC in 2020/21 to simulate scaling and critical mass of SFD reporting through the establishment of a **Training and Knowledge Support Network**.
- **South African Local Government Association (SALGA)**: SALGA is an autonomous association of all 257 South African local governments and aims to represent, promote and protect the interests of local governments and supporting its members to fulfil their developmental obligations. As a full partner in government, SALGA is expected to be an active participant in the intergovernmental relations system, to provide common policy positions on numerous issues and to voice local government interests, as well as provide solutions to the challenges facing local government more generally. SALGA is expected to support the roll-out of the SFD reporting nationally and through its members. Earlier SFDs developed through WRC funding have been facilitated through the national *Municipal Benchmarking Initiative* (MBI) for Water Services in South Africa. It is anticipated that a similar platform will be used to share the benefits of SFD reporting, its roll-out and build communities of practices and foster a relationship of peer-to-peer learning between municipalities to deal with sanitation challenges. SALGA will utilise SFD reports to support municipalities in improving the efficiency of sanitation service delivery and strengthening the development of performance tracking, reporting and comparative assessment systems. When municipal obligations for service provision are not being met (as assessed by SFD reports), potential remedies can be provided for as part of the peer-to-peer learning from MBI.
- **Training and Knowledge Support Network**: Initial seed funding from the WRC will be used to set-up the individual nodes of the **Training and Knowledge Support Network**. The nodes will be preferably housed at a tertiary institution which has access to student capacity. The nodes be responsible for recruiting students, setting up the South African SFD Helpdesk, assisting with the SFD module development and assessment, facilitate the ToT model and with the WRC, SALGA and DWS, develop knowledge products for advocacy and evidence for the establishment of the Brown Drop certification process. The **Training and Knowledge Support Network** will serve as key co-ordination role between the different stakeholders.
- **Energy & Water Sector Education Training Authority (EWSETA)**: **Training and Knowledge Support Network** will build upon and foster the relationship that has been established between the WRC and EWSETA as means of accrediting SFDs as tertiary education module. Capacity building through education, training and skills development must form a major component of support to the sector and is aligned with the outcomes of the National Sanitation Policy 2016. Through the partnership with EWSETA, the **Training and Knowledge**

Support Network will accelerate and expand formal and structured training and educational programmes for SFD reporting that has the potential to be supported by SALGA.

- **Municipalities**: Municipal by-in is required to facilitate SFD reporting and can be used as a means to track the performance of the municipalities in achieving sanitation targets. The **Training and Knowledge Support Network** will facilitate learning through the ToT model, SFD Helpdesk and possibly through Municipal Benchmarking Initiatives.
- **Tertiary Institutions**: Tertiary institutions will be play a pivotal role in developing student capacity to undertake SFD reporting. Accreditation of the SFD module will ensure skills development is acknowledged.
- **Centre for Science and Environment (CSE, India)**: It is envisaged that CSE India will provide technical support for the ToT model and providing the necessary technical support for the development of the SFD module and its assessment according to the SFD Promotion Initiative.
- **Other NGOs/NPOs**: The development of SFD report is open to any parties willing to undertake a SFD. NGO/NPOs are welcome to promote SFD development and reporting provided it is facilitated through the **Training and Knowledge Support Network** to ensure quality of reporting.

WHAT IS THE GOAL OF THE SFD-SA STRATEGY?

Ultimately SFDs are a planning and monitoring approach that looks to integrate sludge management across the sanitation value chain with the aim being to minimise the impact of the public health and the environment. The specific goals of the SFD-SA strategy is listed below:

- Protect public health and the environment from pollution by from sanitation waste.
- Establishment of a **SFD Training and Knowledge Support Network** to develop and standardise methods for SFDs reporting and facilitate the scaling of SFD reporting nationally. Data collected will be continuously collected and interpreted to provide information to stakeholders, including DWS, on the awareness of the health and environmental risks, geographical locations where challenges are experienced that pose a significant risk to public health and the environment or where noncompliance is lower, and highlight best practices where significant improvements have been noted.
- SFD reporting will provide a monitoring system for the sanitation value chain with emphasis on non-sewered sanitation that will form the basis of the Brown Drop certification programme.

RECOMMENDATIONS AND DIRECTION

Original VIP planning and design dates from a time when government intervention was minimal and toilet construction mostly owner driven. Therefore, not much thought was given to what would be done when the pits filled up. The toilet owners and users could build a new toilet as often as required. South Africa is now in a government supply driven mode with a target to have universal sanitation for all that was supposed to have been completed ten years ago. Moreover, in 2001, government adopted a policy that the basic level of municipal services, provisionally defined as access to 6 kl of water per family per month, at least a VIP toilet, a basic amount of energy provision and the provision of a solid waste refuse removal service, should be provided to the poor free of charge. Free basic sanitation, in terms of the Strategic Framework for Water Services, which was published in 2003, also includes the operation and maintenance of the sanitation service. Thus, government has now accepted that it must provide a pit emptying service as part of its commitment to free basic sanitation. To date, this servicing has generally not been carried out effectively and timeously with result that infrastructure deteriorates beyond normal usage and points to a lack of planning and monitoring.

Further, the disposal of pit sludge and wastewater sludges to designated disposal routes as recommended by the sludge management guidelines has been found to be not practical and uneconomical, both from a transport and from a waste handling point of view. There is sufficient

evidence that O&M is a neglected challenge when it comes to the sanitation value chain. With non-sewered sanitation systems, this has become a ticking time-bomb and contributing to secondary backlogs requiring additional infrastructure investment.

The implications of these research findings and observations is that there is an urgent need for sanitation planning and management tools that merges operations, management and regulation and where the focus is on the effective management of sanitation infrastructure instead of reactive operations. The regulation of non-sewered sanitation system is required to ensure public health and environmental safety and ensure longevity of infrastructure investment. Further, there needs to be a focus on all sanitation sludges generated from sewered and non-sewered systems as these as part of city or town sanitation planning.

The Brown Drop certification process achieved through the local modification and adaption of the SFDs will arrest this problem, bring relief and sustainability, as well contribute to meeting the SDG Target 6 goals. SFDs offer this platform for building capacity to deal with the challenges associated with the sanitation value chain for both sewered and non-sewered domains. The one accomplishment that can achieved through the Brown Drop certification is an increase in submission of evidence for Brown Drop assessment, and thus subsequent coverage of all sanitation systems that will enable better planning and management at all government spheres.

The Brown Certification offers several solutions to the current sanitation challenges:

- Creates competition in an industry where it is lacking and provides a minimum standard of excellence that can be benchmarked.
- Incentivised approach allows the identification of well – or poorly performing – municipalities and can provide the basis for peer-to-peer learning through benchmarking initiatives.
- Provides the Regulator with a scientific basis to prioritise regulatory interventions where poor performance and failure are evident or predicted in the near future.
- Provides national and local Government with information and data of the sanitation status along the value chain and offers the opportunity to plan progressively for continued improvement or devise remedial action plans where necessary.
- Provides sector partners responsible for support with information and data on the critical aspects that require support and targeting.
- Stimulates planning and management capacity through SETA courses and highlights training gaps and quality of existing technical persons in local government sanitation services
- Provides the public with accurate and verified information on the status of their local municipality's sanitation service and management performance.

The programmes initiated to facilitate the roll-out of SFDs and subsequent data collection will provide support for policy recommendations to catalyse the Brown certification process. The facilitation of the Brown Drop certification system will alleviate a long-term crisis and ticking time bomb with regards to regular servicing, O&M as well as giving the necessary attention given to sanitation services that will ensure sustainable services, longevity of investments and protection of public health and the environment. The Brown Drop also offers several opportunities for creation of new jobs through infrastructure audits, and possibilities to explore circular economy approaches to sanitation.

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