SFD Promotion Initiative

Dannhauser Local Municipality

Amajuba District Municipality

KwaZulu-Natal, South Africa

SFD Lite Final Report

This SFD Lite Report was created through field-based research by Emanti Management for a Water Research Commission project and as part of the SFD Promotion Initiative.

Date of production: 21 November 2018

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SFD Lite Report

The SFD Promotion Initiative (SFD PI) has developed recommended methods and tools for preparing SFD Graphics and Reports. A full SFD Report consists of the SFD Graphic, the analysis of the service delivery context and enabling environment for service provision in the city for which you are preparing your SFD, and the complete record of data sources used. This analysis allows a systemic understanding of excreta management in the city, with evidence to support it. As a starting point (first step stone) to this (explained in detail in the SFD Manual), the SFD Lite is a simplified reporting template that summarises the key information about the excreta management situation in the city.

SFD Lite Report Dannhauser Local Municipality, South Africa, 2018

Produced by:

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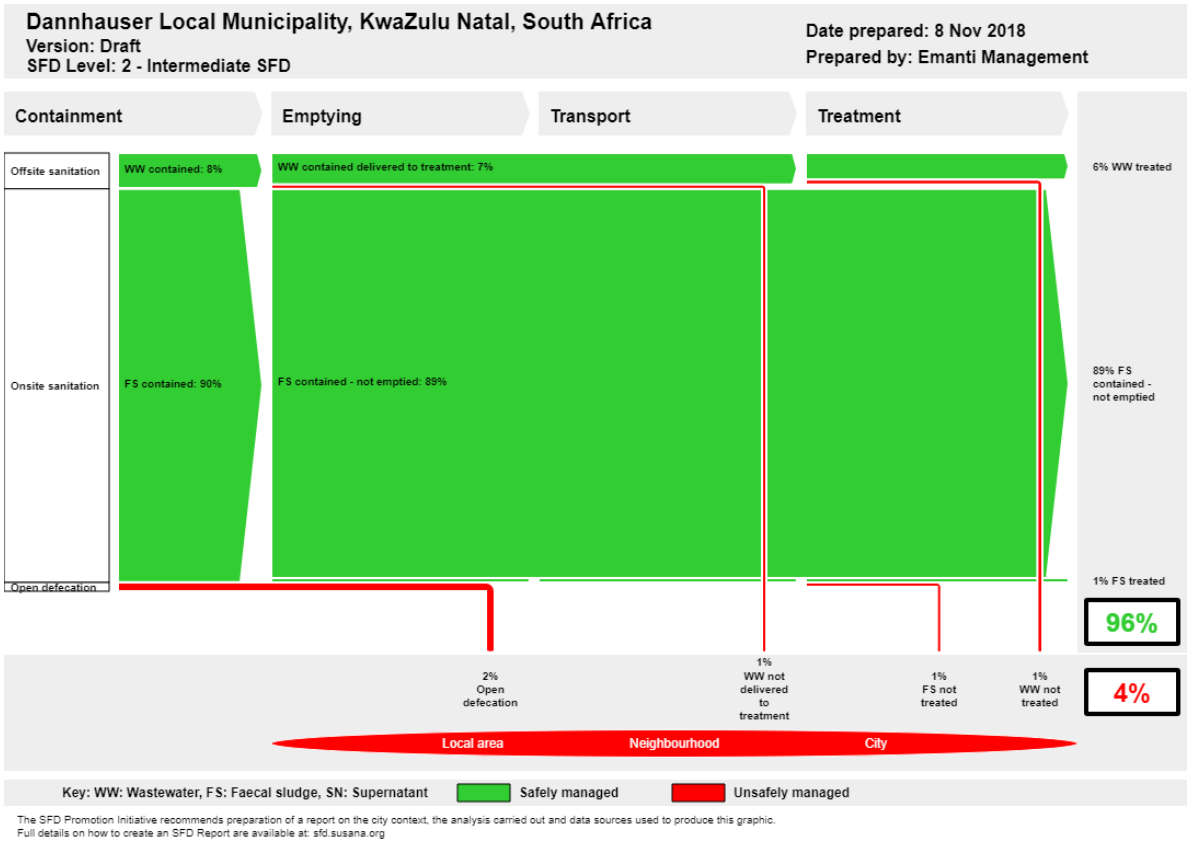
Executive Summary

1. The SFD Graphic



2. Diagram information

Desk or field based:

This is a field based SFD.

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3. General City Information

Dannhauser Local Municipality (LM) is a Category B municipality situated in the Amajuba District Municipality (ADM) in the KwaZulu-Natal province of South Africa. Dannhauser LM covers an area of 1,707 km² and consists of 13 wards. The main towns are Dannhauser and Hattingspruit. The main economic activities include agriculture, mining, manufacturing and services. Dannhauser LM has an estimated 102,937 people and 20,242 households within the 13 wards (5.1 persons per household), with an average annual population growth rate of ~1.3%, and a population density of ~60.3 people per square kilometre. 69% of households are considered formal, while 29% are considered traditional and 1% are considered informal (1%). The average temperature of Dannhauser is approximately 18.9°C, while the average annual rainfall for ADM is consistent throughout the district, and is between 650 mm and 1 000 mm per year.

4. Service outcomes

The following sanitation technologies were noted:

- Toilet discharges directly to a centralised foul / separate sewer – these are flush toilets that are connected directly to the wastewater treatment works.
- Fully lined tank (sealed, no outlet or overflow) – these are:
    - Buried concrete or plastic tanks, both from individual households (flush toilet connected to a conservancy tank) and businesses/light industry (flush toilets connected to a conservancy tank). As there are no municipal standards for the construction of these structures, some of these tanks might not have been constructed appropriately. During the site visit, it was observed that the conservancy tank at the taxi rank was leaking.
    - These are brick/cement block fully lined VIPs (sides and bottom are sealed). To date, no VIP emptying has occurred, and a VIP emptying strategy does not exisit. Fully-lined VIPs are implemented to minimise potential pollution impact on groundwater
- No toilet, open defeacation – these are rural and informal households that have not been serviced, and do not have a toilet. Their status is unknown, and it is assumed that open defecation occurs.

5. SFD development process

Data was collected through secondary sources (reports, plans), and then Dannhauser LM was visited to inspect infrastructure and conduct interviews with the relevant stakeholders, and subsequent follow-ups to confirm understanding. This information was used to fill in gaps and cross-check data collected. The data was fed into the SFD Graphic Generator to calculate the excreta flow in terms of percentage of the population.

96% of the excreta in Dannhauser LM is currently safely managed, while excreta for 4% of Dannhauser LM is not safely managed, as it is either not delivered to treatment (leaking pipes), not treated effectively, or not contained and can pollute groundwater sources and the environment. Furthermore, some customers are not currently serviced, and open defecation is suspected.

Of concern is that the majority of sanitation technologies used are on-site sanitation systems (VIPs), and that an emptying strategy has not yet been developed. With time, VIPs will fill and without subsequent emptying, the current status could deteriorate. An updated SFD for a possible future scenario was also developed, and this highlights the importance of developing and implementing an appropriate VIP emptying strategy.

NOTE: Excreta being safely managed or not is dependent on the containment of the system, and not on whether the waste is safely handled or not.

6. List of data sources

Below is the list of data sources used for the development of the SFD.

- Published reports: Census 2011, Community Survey 2016, socio-economic profile 2014, District Rural Development Plan 2016
- Unpublished documents: IDP, WSDP, Water Balance, NRW Feasibility Study
- Key informant interviews: ADM

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Abbreviations

ADM	Amajuba District Municipality
DM	District Municipality
DWS	Department of Water and Sanitation
FS	Faecal sludge
GDS	Green Drop System
IAM	Infrastructure Asset Management
ICT	Information and Communications Technology
IDP	Integrated Development Plan
IT	Information Technology
LG	Local Government
LM	Local Municipality
MuSSA	Municipal Strategic Self-Assessment
NRW	Non-Revenue Water
O&M	Operations and Maintenance
RDP	Reconstruction and Development Programme
SALGA	South African Local Government Association
SDBIP	Service Delivery and Budget Implementation Plan
SFD	Shit Flow Diagram
StatsSA	Statistics South Africa
VIP	Ventilated Improved Pit Latrine
W_2RAP	Wastewater Risk Abatement Plan
WCDM	Water Conservation and Demand Management
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Service Provider
WTW	Water Treatment Works
WW	Wastewater
WWTW	Wastewater Treatment Works

1. City context

Dannhauser Local Municipality (LM) is a Category B municipality situated in the Amajuba District Municipality (ADM) in the KwaZulu-Natal province of South Africa. ADM is located in the north-western corner of KwaZulu-Natal, and is made up of three local municipalities namely: (1) Newcastle LM (KZN 252), (2) Dannhauser LM (KZN 253), and (3) eMadlangeni LM (KZN 254).

Dannhauser LM covers an area of 1,707 km² and consists of 13 wards. The main towns are Dannhauser and Hattingspruit. Dannhauser town is located midway between Durban (KZN) and Johannesburg (GP), and is surrounded by some large coal mines. Dannhauser functions as a small rural service centre, and is not a large employment generator. The main economic activities include agriculture, mining, manufacturing and services. The majority of its population speaks *IsiZulu* (Stats SA, 2011).

ADM is a Water Services Authority (WSA) for its area of jurisdiction in terms of the Water Services Act (Act 108 of 1997, Water Services Act). It therefore has statutory responsibilities and accountability with respect to the provision of water services. ADM is the appointed WSA and WSP for Dannhauser and eMadlangeni LMs, while Newcastle LM is the WSA and WSP for its LM.

ADM has an estimated total population of 531,327 people who are accommodated in 117,256 households (Amajuba District Municipality, 2018a). Dannhauser LM has an estimated 102,937 people and 20,242 households within the 13 wards (Stats SA, 2016) (5.1 persons per household). The average annual population growth rate for Dannhauser LM is ~1.3% (Amajuba District Municipality, 2018a), and the population density is ~60.3 people per square kilometre. Of the 20,242 households, 14,020 are considered formal (69%), 261 are considered informal (1%), and 5,936 (29%) are considered traditional.

ADM climatic conditions vary noticeably between summer and winter months ranging from very cold temperatures during winter to high summer temperatures. The average temperature for ADM is approximately 17°C, and for Dannhauser is approximately 18.9°C. The minimum temperature for ADM is below 0°C during winter months and often higher than 30°C in the summer months. The average annual rainfall for ADM is consistent throughout the district with no major difference between the local municipalities, and is between 650 mm and 1 000 mm per year (Amajuba District Municipality, 2018a).

The geology of ADM can be described as consisting mainly of shale (with coal in certain instances), mudstones, sandstone and siltstones of the Ecca Group, Karoo Sequence, with intrusive dolerite. The major soil types covering Dannhauser LM are loam soil, sandy clay loam, silt loam and silty clay soils. Loam soils, which generally contain more nutrients and humus than sandy soils, have better infiltration and drainage than silty soils, and are easier to till (Department Rural Development and Land Reform, 2016).

The ADM has five rivers namely Buffalo, Ncandu, Ngagane, Uthukela Uphongolo, and these rivers are the main water sources for domestic water supply and agricultural activities. The Buffalo River is the major system, draining into the UThukela River, and the Ncandu and Ngagane Rivers are the main tributaries. Although the Ngagane River catchment is said to have fairly good quality water, pollution problems have been cited, including high salinity and metal salts (by mining and industries) (Amajuba District Municipality, 2018a).

In Dannhauser LM, up to 80% of households have a piped water supply either to their dwelling or on site (e.g. communal stand pipes). Unauthorized illegal connections are largely contributing to an increased number of households with yard connections. Almost 13% of households are reliant on natural and other water supplies (boreholes, springs). The quality of the water obtained from these sources is unknown and cannot be guaranteed, thus possibly leading to health problems.

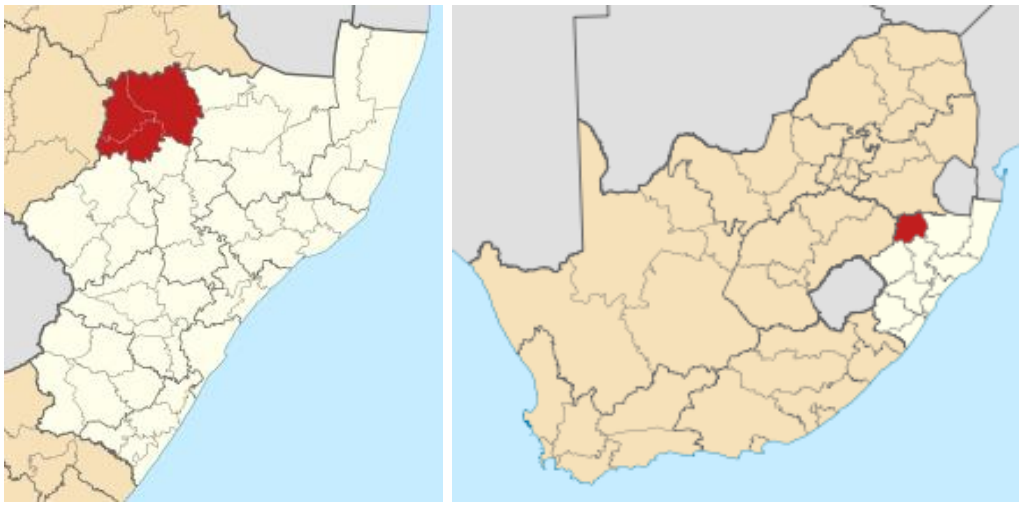

Figure 1: Location of Amajuba District Municipality within KwaZulu-Natal Province of South Africa

Figure 2: Location of Dannhauser Local Municipality within Amajuba District Municipality

2. Service outcomes

Service outcome analysis is based on secondary sources. The following key sources of data are used:

- StatsSA Census (2011)
- StatsSA Community Survey (2016)
- Integrated Development Plan for ADM (2018-2019) (and associated annexures)
- Draft District Rural Development Plan: Amajuba District Municipality (2016)
- Water Services Development Plan for Amajuba District Municipality (2016)
- IWA Water Balance for Amajuba District Municipality (2017/2018)
- Feasibility Study For The Roll-Out Of Non-Revenue Water Interventions Over The Next Three Years According To The Approved Strategic Management Plan for Amajuba District Municipality (2018)
- Amajuba District Municipality Socio-Economic Profile (2014)

Data on emptying and transport is not currently closely monitored, and is mostly qualitative in nature.

2.1 Overview

This section presents the range of sanitation technologies/infrastructure, methods and services designed to support the management of faecal sludge (FS) and/or wastewater (WW) through the sanitation services chain in Dannhauser LM. The details on the quantitative estimations are presented in the table below and sections that follow.

Table 1: Sanitation technologies and contribution of excreta in terms of percentage of population

No.	Sanitation technologies and systems as defined by:		SFD reference variable	Percentage of population
	Amajuba DM	SFD promotion initiative		
1	Toilet flushes directly to sewer	Toilet discharges directly to a centralised foul/separate sewer	T1A1C2	8%
2	Septic and conservancy tanks (plastic or concrete)	Fully lined tank (sealed), no outlet or overflow	T1A3C10	1%
3	VIPs – fully lined	Fully lined tank (sealed), no outlet or overflow	T1A3C10	89%
4	Not serviced	No toilet, open defecation	T1B11C7 to C9	2%

2.1.1 Containment

There is a limited sewerage network, with only 1 out of 13 wards (Ward 2-8% of population) with off-site formal waterborne sewer system linked to the Dannhauser Wastewater Treatment Works (WWTW) (Tweediedale Ponds) and Durnacol Wastewater Treatment Works (activated sludge – oxidation ditch) with domestic effluent originating from Dannhauser (town).

The remaining areas are reliant on on-site sanitation systems. The following on-site containment systems are generally noted:

- Flush toilet connected to a conservancy tank (concrete or plastic) for an individual house/building, and
- VIPs (fully lined).

There is a mixture of septic tanks (mostly on farms, and self-treating) and conservancy tanks (mostly small business and in town, and a rate is paid per load disposed by the municipality), but little clarity on the actual number of each type of structure. At this stage there are no specific municipal design standards for septic tanks or conservancy tanks and therefore the size, material of construction, configuration of installed infrastructure, etc. is variable.

The conservancy tanks have no formal outlets, they are defined as fully lined tanks within the SFD nomenclature. ADM does not seem to currently have an asset register/database of all these septic/conservancy tanks. Most of the conservancy tanks either serve small businesses/industry in Dannhauser (there is also one public toilet related conservancy tank at the taxi rank), or are located in the nearby town of Hattingspruit. It is noted that these conservancy tanks sometimes overflow, thereby spilling wastewater into the environment.

There are parts of Ugie urban and rural areas where communities use VIP toilets. All VIPs installed within Dannhauser LM are thought to be fully lined (i.e. both on sides and bottom, due to high groundwater table/risk of groundwater pollution). To-date, these toilets have never been emptied, and indications are that some of these VIPs are filling rapidly (i.e. were they all dug deep enough?). In rural areas, communities are used to covering up and abandoning a full VIP and relocating the VIP to a new location. In the urban context, limited space could prohibit this practice.

2.1.2 Emptying and Transport

Dannhauser LM have access to only 1 honeysucker (vacuum truck), mostly functioning in Hattingspruit, and also supporting conservancy tank emptying in Dannhauser. Due to the limited number of tanks that need to be emptied (mostly servicing businesses), the truck currently only operates approximately 3 times per week.

There is one public toilet in Dannhauser that is connected to a conservancy tank. This tank is emptied on a monthly basis via honeysucker.

Wastewater/sludge emptied from all conservancy tanks is transported via honeysucker to the Dannhauser #7 Pump Station for disposal. The municipality have had incidents in the past where the driver could not access the pump station, and therefore disposed of the truck contents outside the pump station, creating nuisance conditions. An arrangement has now been made that if there is no

access to the pump station, the driver can dispose of the waste at the Tweediedale Ponds. The pump station is, however, preferred as this is a more controlled environment.

ADM have 1 vacuum truck to service Dannhauser LM. The truck has a capacity of 6,000 L. The truck is operated by 1 driver and 1 or possibly 2 assistants. Personnel are issues with appropriate personal protective equipment (PPE) including boots and gloves, but they don't always use provided equipment. If the vacuum truck breaks down, ADM have an existing emergency appointment with a service provider, who is then able to service and empty the conservancy tanks.

Businesses/industries have accounts with the municipality, and therefore the emptying of conservancy tanks forms part of their monthly bill. When a tank is emptied, it is recorded in a logbook, and the customer is asked to sign off. For businesses/industries without accounts, upfront payment is required prior to the tank emptying service being provided.

Any wastewater/sludge discharges to the ADM sewer network/ponds needs to be paid for (i.e. even if the user has paid for the honeysucker of a private service provider to empty their tank). As the tanks vary in size, it is difficult to estimate the average number of tanks emptied per day. A lack of adequate record checking and verification, and associated data analysis/interpretation also makes this a challenge.

VIPs are currently not emptied. There is currently no strategy or plan within ADM to deal with VIP empting and disposal/treatment. There have been limited cases of pits being full after a short-period (e.g. 6 months), and it is assumed that these pits were not dug deep enough by contractors (i.e. need for improved supervision of contractors). To-date, the contents of VIPs have not yet been analysed or categorised. User education of VIP operation, maintenance and management is performed by ADM when such structures are handed over.

The ADM is not aware of manual emptying from on-site sanitation systems (e.g. VIPs, conservancy tanks) occurring within Dannhauser LM.

ADM have an existing appointment with a honeysucker service provider, who are able to assist with providing a service in an emergency (i.e. should the municipal honeysucker break down and require maintenance, supply chain management can mobilize quickly). There is currently very little monitoring and management of vacuum truck emptying (i.e. don't have a system in place to record and track trucks at pump station/WWTWs), and monitoring at point of discharge to the WWTWs does not appear to be occurring (i.e. do emptiers actually deliver collected sludge to the designated discharge points?). Despite this, it is noted that from a municipal perspective, as municipal officials operate the honeysucker, they assume they do deliver at the specific discharge points (e.g. pump station, pond system), as these officials will not be turned away, and therefore have no reason to illegally discharge. Furthermore, the distance to travel from the conservancy tanks to the discharge point is relatively

short (<15 km). However, as emptiers are salaried staff, there does not seem to be an incentive to manage time efficiently.

The sewer system is very old, with some pipes constructed from earthenware material (clay), with the balance of pipe materials either being AC or uPVC. The actual length of sewers is not known.

When power failures occur, some overflows of sewage pump stations are noted, and not all wastewater would end up at the two wastewater treatment works.

A key aspect to note is that in 2013 water and wastewater related assets were transferred from Uthukela Water to ADM. At this stage it was noted that the current infrastructure asset registers were incomplete (e.g. no as-built drawings), and ADM embarked on addressing these gaps. However, as funding for this aspect is currently limited, ADM continue to complete the asset register in a piecemeal fashion. This will account for some of the noted knowledge gaps.

2.1.3 Treatment and disposal

Dannhauser LM is serviced by two (2) wastewater treatment works, namely the Dannhauser WWTW (Tweediedale Ponds) and the Durnacol WWTW, with eight (8) associated pump stations. The limited sewerage network is confined to Ward 2 and conveys wastewater to the two WWTW.

The Dannhauser WWTW (Tweediedale Ponds) (design capacity: 2 ML/d) consists of 14 ponds and also accepts tankered effluent (if there is no access to Dannhauser #7 Pump Station). The works are properly fenced with controllable access via a security guard. At the time of the site inspection, there was however evidence that animals had recently entered the site (visible droppings – likely goats). Sludge appears to be accumulating in the ponds, and access to some of the ponds is challenging.

Figure 3: Ariel view of Dannhauser WWTW (Tweediedale Ponds)

The Durnacol WWTW (design capacity: 2 ML/d) is an oxidation ditch system based on activated sludge treatment technology. Final effluent is disinfected before it is released to the nearby wetland. The works are properly fenced with controllable access via a security guard. Only 3 of the on-site drying beds are in use, and the sludge digester is no longer in use.

Figure 4: Ariel view of Durnacol WWTW

To-date, the wastewater sludge from both WWTWs has not been categorised (only drinking-water treatment related sludge for Dannhauser LM has been categorised). Currently, there is no beneficial use of sludge, and sludge is stockpiled on-site at the wastewater treatment works (i.e. not disposed of at a landfill).

An overview of the two WWTWs is presented in the table that follows.

Table 2: Overview of Dannhauser LM WWTWs

Name	Treatment type	Design Capacity (ML/day)	Winter Flow (ML/day)	Summer Flow (ML/day)	Sludge treatment	Sludge disposal/use
Dannhauser WWTW (Tweedledale Ponds)	Ponds	2	0.4-0.6	0.8-0.9	None	None, stockpiled
Durnacol WWTW	Oxidation ditch (activated sludge)	2	1.0-1.5	1.8-2.0	None	None, stockpiled

2.1.4 Human resources

It is noted that within Engineering Services in ADM for 2018/2019, of a total number of posts of 111, 78 posts are filled (70%), while 33 posts are vacant (30%) (Amajuba District Municipality, 2018a). This could indicate potential gaps with fulfilling all required sanitation services functions/tasks.

2.1.5 Service Charges

The following charges are noted (Amajuba District Municipality, 2018a):

- Once-off connection charge: New connections
  - Water
    - Connections 25 mm and less: cost + 10%
    - Connections greater than 25%: cost + 10%
  - Sanitation
    - All connections: cost + 10%
- Service charges
  - Water (Approved 2018, VAT excl.)
    - Normal consumption: Domestic
      - Steps
        - 0-6 kl: R7.16
        - 7-20 kl: R8.30
        - 21-40 kl: R9.96
        - 41-60 kl: R12.29
        - 60 kl+: R14.86
  - Sanitation (Approved 2018, VAT excl.)
    - All customers per kl: R5.02
    - Emptying septic tanks per load: R638.40
- Punitive tariffs and controls are in place when water availability is scarce.

2.1.6 Water Conservation and Demand Management

The table below shows the water sources within Dannhauser LM, and the associated water treatment works.

Table 3: Overview of Dannhauser LM water sources

Area Name	Raw Water Source	Water Treatment Works (WTW)
Dannhauser (including eMafusini)	Ntshingwayo Dam	Dannhauser WTW
Durnacol	Ntshingwayo Dam	Durnacol WTW
Hattingspruit	Tom Worthington Dam	Biggarsberg WTW
Alcockspruit/Koppie Alleen	Ntshingwayo Dam	Ngagane WTW
Buffalo Flats	Ntshingwayo Dam	Ngagane WTW
Ngagane (Part of Buffalo Flats)	Ntshingwayo Dam	Ngagane WTW

Of importance to note is that the Ngagane WTW is operated and managed by Newcastle Local Municipality, and they assist ADM with water supply to the noted rural areas. In addition, The ADM Water Supply Master Plan (2011) indicates that there are 988 boreholes in the Buffalo Flats area, which will continue to be used as a backup supply.

As of April 2018, water losses were 43% and non-revenue water (NRW) was 67%, while the total billed volume of water is only 32% of the total input volume, which requires further investigations in the form of meter audits and billing inaccuracies (Amajuba District Municipality, 2018c). Considering the various areas within Dannhauser LM, and the associated standard IWA water balance for Amajuba DM, the following key related indicators are noted (as of July 2018) (Amajuba District Municipality, 2018b):

Table 4: Status overview of key WC/WDM indicators

Indicator	Dannhauser (town)	Durnacol	Hattingspruit	Buffalo Flats
Length of mains (km)	25	13	5	793
Water connections	1 068	591	99	14 051
Water connections – metered	1 031	572	63	348
Water Connections – unmetered	37	19	36	13 703
Non-revenue water (NRW) (%)	21.4%	69.4%	45.5%	79.3%
Infrastructure Leakage Index (ILI)	20.4	116.9	53.3	20.0
System Input Volume (SIV) (kl/annum)	47 572	41 988	7 058	225 415
SIV unit consumption (litres/capita/day)	346	459	226	105

For reference purposes, the current South African average consumption of 237 litres per person per day under normal conditions (DWS, 2018). Although not quantified, it is estimated that a large proportion (~95%) of all connections in the Buffalo Flats rural area are illegal connections. ADM installed community standpipes at appropriate points, but communities have connected to these pipes and made their own connections. Water losses from Buffalo Flats is particularly high. Newcastle LM supply approximately 7 ML/day to ADM rural areas. However, the Waterval Prison (consuming ~2 ML/day) is the only paying customer, and payment for the remaining ~5 ML/day is not recovered/unaccounted for.

The Strategic Management Plan for the reduction of Non-Revenue Water was approved by Council. The WC/WDM strategy includes the following objectives:

- Implement leak detection to minimise real water losses
- Address apparent losses
- Establish district metered areas

- Introduce pressure management
- Set up internal NRW unit
- Determine rehabilitation priority needs and implement.

The figure below summarises the planned interventions to meet the above objectives (Amajuba District Municipality, 2018c).

	Description		
1	**Community participation**		
		PSC meeting expenses (travelling)	
		Skills transfer for local contractors (plumbing/leak detection and repair)	
2	**Pressure Management**		
		Commence investigations in Emadlangeni (installation of PRV's)	
		Investigate other priority district metered areas for PRV installations	
3	**Address real losses**		
		Physical inspection of all networks	
			Target non-revenue water areas of influence
		Leak detection making use of equipment purchased for this purpose	
		Carry out repairs to identified leaks	
4	**Active Leakage Control (ongoing planned interventions)**		
		Plan continual leakage surveys	
		Continual night flow analysis	
		Temporary placement of leak noise detectors	
		Monitoring of efficiency indicators on a monthly bases (Water module)	
5	**Address apparent loss control**		
		Meter audit of all billing meters	
		Investigate sustainability of water tariffs	
		Investigate feasibility to meter all unauthorised connections within Buffalo Flats	
		Meter all standpipes	
6	**District metered areas**		
		Reduce exiting zones into smaller discrete zones	
		Construct chambers with pipe specials and specialised PRV'S to suit application	
7	**Spead and quality of repairs**		
		Link Water Module to Call Centre	
8	**Rehabilitation/upgrade of water infrastructure/assets**		
		Install scada systems to all pump stations	
		Incorporate newly installed bulk/zonal meters into water module	
		Repairs to leaking reservoirs/unforseen	
9	**Institutional sustainability**		
		Set up internal NRW unit	
			Skills transfer
			Monthly reporting requirements
			Technical support

Figure 5: Amajuba DM Water Conservation/Water Demand Management planned interventions

2.2 SFD matrix

The final SFD for Dannhauser LM is presented in **Appendix 6.1**.

2.2.1 SFD matrix explanation

In this report, all sanitation infrastructure is categorised according to their design and functioning as per SFD terms. Below is a description of each of the sanitation technologies in Dannhauser LM.

- Toilet discharges directly to a centralised foul / separate sewer – these are flush toilets that are connected directly to the wastewater treatment works.
- Fully lined tank (sealed, no outlet or overflow) – these are:
    - Buried concrete or plastic tanks, both from individual households (flush toilet connected to a conservancy tank) and businesses/light industry (flush toilets connected to a conservancy tank). As there are no municipal standards for the construction of these structures, some of these tanks might not have been constructed appropriately. During the site visit, it was observed that the conservancy tank at the taxi rank was leaking.
    - These are brick/cement block fully lined VIPs (sides and bottom are sealed). To-date, no VIP emptying has occurred, and a VIP emptuing strategy does not exisit. Fully-lined VIPs are implemented to minimise potential pollution impact on groundwater
- No toilet, open defeacation – these are rural and informal households that have not been serviced, and do not have a toilet. Their status is unknown, and it is assumed that open defecation occurs.

Considering the above, the following is noted:

Off-site

According to municipal records, 8% of the population are serviced via off-site sanitation. All of this wastewater is transported to the two (2) wastewater treatment works, namely the Dannhauser WWTW (Tweediedale Ponds) and the Durnacol WWTW.

In order to determine the proportion of wastewater in the sewer system that is actually delivered to centralised wastewater treatment works, the status of the sewer network needs to be known. Although the average life remaining of the sewer network is unknown (asset register is incomplete), it is assumed that the existing sewer systems in some areas of Dannhauser LM are beyond their design lives and in poor condition. It is therefore anticipated that leakage will occur.

Considering a current water supply of approximately 3.6 ML/day for Dannhauser LM, and if we assume that 70% of the water supply will enter the sewerage system (i.e. ~2.5 ML/day), and if there was no leakage, we would expect the same quantity at the WWTWs (i.e. ~2.5 ML/day). Currently, the two WWTWs are receiving and treating (on average) ~2.25 ML/day. The calculated leakage within the sewer network is therefore approximately 10% ((2.5-2.25) / 2.5 = 10%), and this proportion of wastewater is therefore not delivered to the wastewater treatment works. We therefore assume that 90% is delivered to the centralised WWTWs for treatment. Overall, this translates into approximately 1% of wastewater that is not delivered to treatment.

Once the wastewater reaches the WWTWs, it is treated to meet specified requirements. Considering the various flows per WWTW and associated overall effluent compliance per WWTW, an overall flow weighted compliance of 84% is noted (see table below). This implies that a small proportion of the wastewater is not treated effectively, and can pollute the environment. Overall, this translates into approximately 1% of wastewater that is not treated effectively.

Table 5: Compliance for Dannhauser LM WWTWs

No.	Wastewater Treatment Works (WWTW)	Average Flow (Ml/day)	Overall Effluent compliance (%)
1	Dannhauser WWTW (Tweediedale Ponds)	1.57	82%
2	Durnacol WWTW	0.68	91%
	Total	**2.25**	**84%**

To-date, wastewater sludge has not yet been analyzed or categorized, and therefore sludge compliance still needs to be determined. Wastewater sludge is currently stockpiled at the respective wastewater treatment works.

On-site

Of the 630 conservancy tanks (concrete or plastic, sealed, fully lined), 80% (504) are considered to be in good condition (i.e. sealed, not leaking), while 20% (126) are considered to be in poor condition (i.e. possibly leaking to environment, but don't know where).

Of the total 93,684 VIPs, all (i.e. 100%) are fully lined with brick/cement blocks (sides and bottom), so as to prevent potential groundwater pollution. As these VIPs are relatively new, they are considered to be in good condition. ADM have not yet emptied any VIPs and a VIP emptying strategy has not yet been developed. A limited number of cases of "full VIPs after 6 months" have been reported, and in these cases it is suspected that contractors did not dig deep enough pits (as per required specifications).

Therefore, a total of 93,684 + 504 = 94,188 (89.4% of total households) are considered to be served by fully lined (sealed) tanks in good condition, while 126 (0.1% of total households) are considered to be in poor condition (Total = 94,314 or 89.5%).

It is assumed that 50% of the faecal sludge is emptied from conservancy tanks by the municipal honeysucker (vacuum truck). As VIPs are never emptied and faecal sludge is not transported to any treatment facility, these aspects are not included. Considering this, 90% of the faecal sludge is contained in fully lined (sealed) tanks (89% from VIPs and 1% from conservancy tanks). Only 1% is emptied (from conservancy tanks, rounded up), while 89% is not emptied (from VIPs). The 89% faecal sludge that is contained from VIPs is never emptied, but considered to be safely managed as it is adequately contained (fully lined VIPs), with low groundwater risk. 50% of the faecal sludge in the conservancy tanks is contained and never emptied, while the other 50% is emptied and transported to the wastewater treatment works. As it is noted that alternative points of discharge do not appear to be feasible, it is assumed that all of the faecal sludge emptied from the tanks is delivered to the wastewater treatment systems (i.e. no illegal dumping). Once it reaches the wastewater treatment works, it is treated to meet specified requirements. As previously noted in Table 5, and considering the

various flows per WWTW and associated overall effluent compliance per WWTW, an overall flow weighted compliance of 84% is noted.

Open defecation

Currently, 2,404 households are not serviced (i.e. ~2%). This is considered the sanitation backlog, and needs to be addressed. As Dannhauser LM do not know the sanitation practices for these households, it is assumed that current sanitation practices are unsafe, and that open defecation is occurring.

Table 6: Description of variables used in SFD

Variable	Description
W4a	WW delivered to centralized treatment plant
W5a	WW treated at centralized treatment plant
F3	FS emptied
F4	FS delivered to treatment plant
F5	FS treated

It can be concluded that excreta of 96% of the population is currently safely managed in Dannhauser LM, and that 4% of excreta is discharged into the environment untreated. The following table figure summarizes the percentages of the population using each sanitation technology and the method along the service chain.

Dannhauser Local Municipality, KwaZulu Natal, South Africa, 8 Nov 2018. SFD Level: 2 - Intermediate SFD
Population: 102937
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

System label	Pop	W4a	W5a	F3	F4	F5
System description	Proportion of population using this type of system	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C2 Toilet discharges directly to a centralised foul/separate sewer	8.0	90.0	84.0			
T1A3C10 Fully lined tank (sealed), no outlet or overflow	90.0			1.0	100.0	84.0
T1B11 C7 TO C9 Open defecation	2.0					

Figure 6: SFD Matrix for Dannhauser LM (2018)

Of concern is that the majority of sanitation technologies within Dannhauser LM are on-site sanitation systems (VIPs), and that an emptying strategy has not yet been developed. With time, VIPs will fill and without subsequent emptying, the current status could therefore deteriorate if this is not considered in the near future. Further discussion on this topic, by means of the consideration of a possible future scenario, is presented in **Section 6.2** of this report.

2.2.2 Risk of groundwater contamination

Water for both urban and rural areas of Dannhauser LM is supplied from various water treatment works via pipeline to households, with the majority of households either receiving water via household taps, yard connections or communal standpipes. Raw water is obtained from various surface water sources (i.e. dams).

A number of boreholes exist, and are used as a back-up resource in times of drought. As such, protection of these water sources is essential. VIPs constructed in the area are therefore fully lined. Although the groundwater is therefore not generally being used, climate change impacts and the increasing water scarcity facing many parts of South Africa and KwaZulu-Natal.

The geology of the area can be described as consisting mainly of shale (with coal in certain instances), mudstones, sandstone and siltstones of the Ecca Group, Karoo Sequence, with intrusive dolerite. Dannhauser LM is largely comprised of Arenite and small portions are covered in Dolerite and Shale. The major soil types covering Dannhauser LM are loam soil, sandy clay loam, silt loam and silty clay soils (Department Rural Development and Land Reform, 2016).

Of concern, is that in Dannhauser LM, an appropriate asset register of conservancy tanks does not exist, and therefore there is a risk that such systems could be damaged/broken and polluting the environment, and possible impacting on groundwater quality. On-going groundwater quality monitoring by ADM appears to indicate no impact on groundwater quality.

There is a need to create awareness among the rural people about the need to ensure that VIPs are adequately sealed when closed/moved/new pit dug, and of the effects of using polluted water.

3. Stakeholder engagement: key interviews

The relevant ADM staff were contacted through e-mail, letter and telephone call prior to the visit to Dannhauser LM. The purpose of the SFD study and depth of data required was conveyed through an introductory letter to respective staff. Although a number of stakeholders of government departments were noted, this SFD study aimed to focus on interviews with staff from ADM, and their associated service providers.

Interviews were held with appropriate WSA superintendents and technicians who report directly to the Municipal Manager (currently no Technical Director – vacancy), who also accompanied the team to the site inspection. During the site inspection, interviews were held with the process controllers at the Dannhauser WWTW (Tweediedale Ponds) and Durnacol WWTW.

As the municipal vacuum truck was being serviced (only have 1 truck), interviews with the driver and assistants were not be conducted.

A site inspection assisted with verifying data obtained from ADM published reports (e.g. IDP, WSDP). The key informant interviews and data collected helped in understanding the existing situation and upcoming developments plans in the sanitation sector.

4. Acknowledgements

This report was compiled for a Water Research Commission project and as part of the SFD Promotion Initiative. We would like to thank Luyanda Simelane (Process Technician), Siphamandla Buthelezi (Superintendent), Sabelo Dube (Technician), Nokwazi Shabalala (Technician), and all participating ADM staff for giving time and necessary information for the assessment.

5. References

1. Amajuba District Municipality (2018a) *Integrated Development Plan for ADM (2018-2019)* (and associated annexures).
2. Amajuba District Municipality (2018b) *IWA Water Balance for Amajuba District Municipality (2017/2018)*.
3. Amajuba District Municipality (2018c) *Feasibility Study For The Roll-Out Of Non-Revenue Water Interventions Over The Next Three Years According To The Approved Strategic Management Plan.*
4. Amajuba District Municipality (2016) *Water Services Development Plan for Amajuba District Municipality*.
5. Department Rural Development and Land Reform (2016) *Draft District Rural Development Plan: Amajuba District Municipality*.
6. Department Water and Sanitation (2018) *Strategic Overview of the Water Sector in South Africa 2018.*
7. KwaZulu-Natal Provincial Treasury (2014) *Amajuba District Municipality Socio-Economic Profile*.
8. StatsSA (2011) *Census 2011*.
9. StatsSA (2016) *Community Survey 2016*.
10. www.municipalities.co.za – *Amajuba District Municipality Locality Map* (accessed 31 October 2018).

6. Appendix

6.1 SFD Matrix

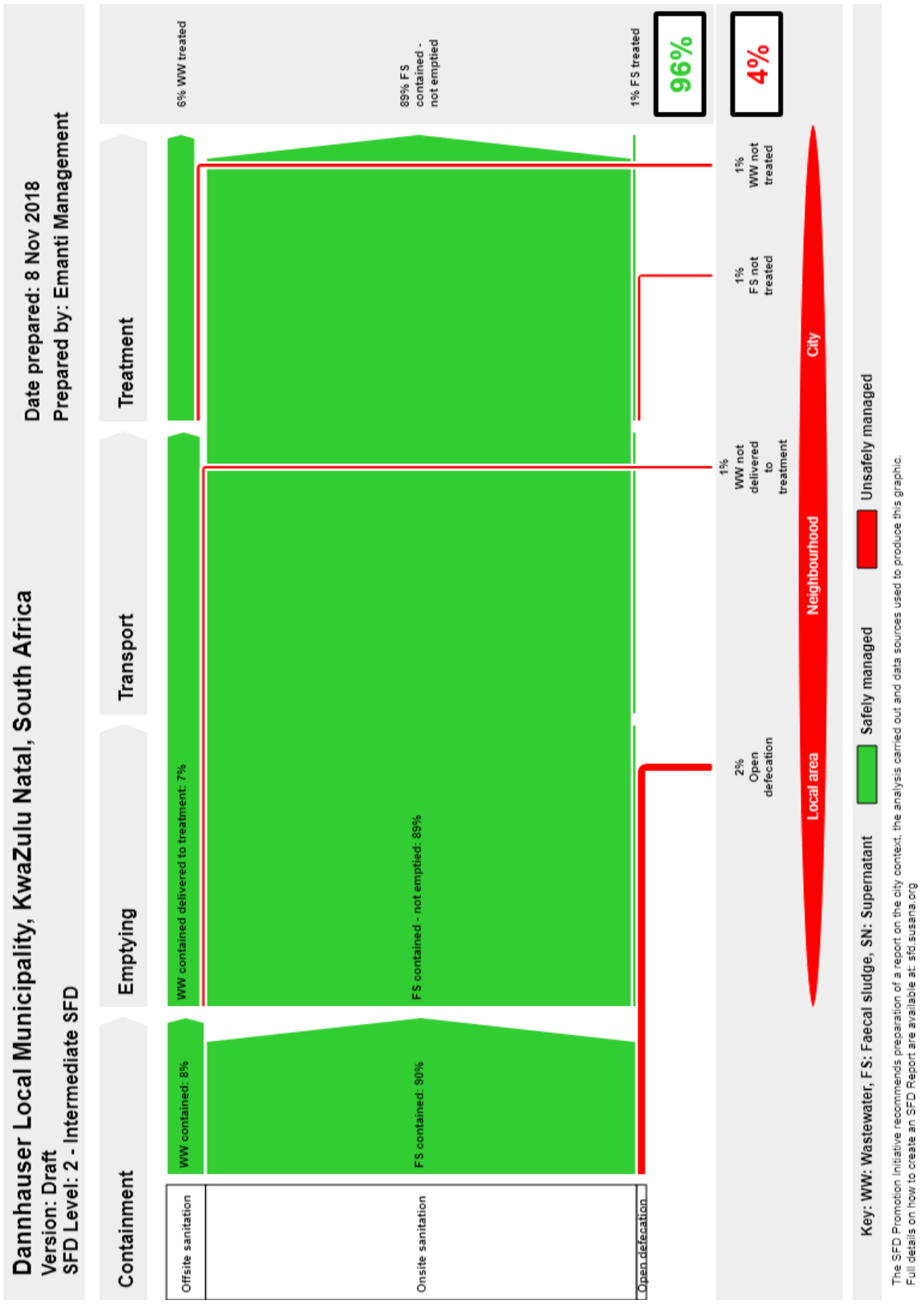

Figure 7: SFD matrix

6.2 Possible Future Scenario

Of concern is that the majority of sanitation technologies within Dannhauser LM are on-site sanitation systems (VIPs), and that an emptying strategy has not yet been developed. With time, VIPs will fill and without subsequent emptying, the current status could therefore deteriorate if this is not considered in the near future. Further discussion on this topic, by means of the consideration of a possible future scenario, is presented below.

In this scenario, it is assumed that:

- 25% of current VIP users, will remain as is.
- 25% of VIPs will never be emptied, but abandoned when full and adequately covered with soil, no outlet or overflow.
- 25% of VIPs will never be emptied but abandoned when full, but NOT adequately covered with soil, no outlet or overflow.
- 25% of households will move to unlined pits.

In this future scenario, current VIPs are re-categorised as follows:

Table 7: Possible Future scenario – re-categorisation of VIPs

	SFD Categorisation	Current Status		Possible Future Scenario	
		%	Number	%	Number
1	Full lined (sealed) tank	100%	93 684	25%	23 421
2	Pit (all types) never emptied, but abandoned when full and covered with soil, no outlet or overflow	0%	0	25%	23 421
3	Pit (all types) never emptied but abandoned when full but NOT adequately covered with soil, no outlet or overflow	0%	0	25%	23 421
4	Unlined pits	0%	0	25%	23 421
	Totals	**100%**	**93 684**	**100%**	**93 684**

An updated SFD for this possible future scenario is indicated overleaf. Considering this possible future scenario, it can be concluded that excreta of 74% of the population in Dannhauser LM would be safely managed, while 26% of excreta would be discharged into the environment untreated. This highlights the importance of developing and implementing an appropriate VIP emptying strategy.

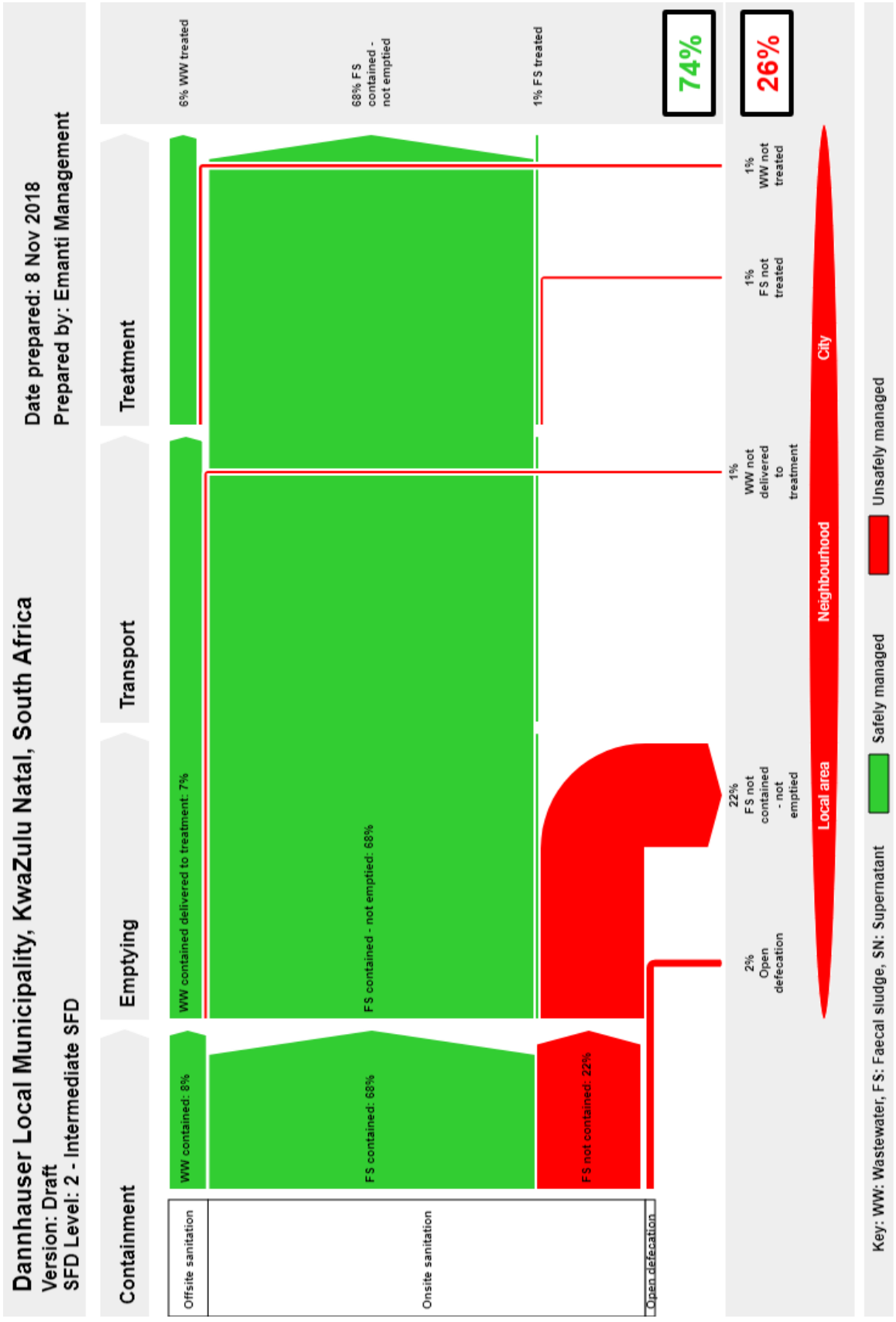

Figure 8: SFD matrix – Possible Future Scenario

6.3 Stakeholder identification

Table 8: Stakeholder identification

No.	Stakeholder group	In xxx context
1	City council / Municipal authority / Utility	Water Services Authority (WSA): Amajuba District Municipality Water Services Provider (WSP): Amajuba District Municipality
2	Ministry in charge of urban sanitation and sewerage	National: Department of Water and Sanitation Provincial: Department of Water and Sanitation (KwaZulu-Natal)
3	Ministry in charge of urban solid waste	National: Department of Environmental Affairs Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
4	Ministry in charge of urban planning, finances and economic development	National: Department of Human Settlements Provincial: KwaZulu-Natal Department of Human Settlements National: National Treasury Provincial: KwaZulu-Natal Provincial Treasury Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
5	Ministry in charge of environmental protection	National: Department of Environmental Affairs Provincial: Department of Economic Development, Tourism and Environmental Affairs of KwaZulu-Natal (EDTEA)
6	Ministry in charge of health	National: Department of Health Provincial: KwaZulu-Natal Department of Health
7	Service provider for construction of on-site sanitation technologies	Various, by tender appointment
8	Service provider for emptying and transport of faecal sludge	Various, by tender appointment
9	Service provider for operation and maintenance of treatment infrastructure	N/A Performed by Amajuba District Municipality
10	Market participants practicing end-use of faecal sludge end products	N/A
11	Service provider for disposal of faecal sludge (sanitary landfill management)	N/A
12	External agencies associated with faecal sludge management services (e.g. NGOs, academic institutions, donors)	N/A

6.4 Tracking of engagement

Table 9: Tracking of stakeholder engagement

Name of organization	Name of contact person	Designation	Date of engagement	Purpose of engagement
Amajuba District Municipality	Luyanda Simelane	Process Technician	24th October 2018	Introducing SFD, securing support for project
Amajuba District Municipality	Luyanda Simelane	Process Technician	31st October-1st November 2018	Data collection, collation, verification and site visits including key informant interviews
Amajuba District Municipality	Siphamandla Buthelezi	Superintendent		
Amajuba District Municipality	Sabelo Dube	Technician		
Amajuba District Municipality	Nokwazi Shabalala	Technician		
Amajuba District Municipality	Luyanda Simelane	Process Technician	2-6 November 2018	Data gaps, follow-ups
Amajuba District Municipality	Luyanda Simelane	Process Technician	23-30 November 2018	Draft report review and finalisation

6.5 Selected pictures taken during visit

Figure 9: Newly constructed VIP and indicating ability to be connected to water supply (in future, if required)

Figure 10: Dannhauser WWTW (Tweediedale Ponds)

Figure 11: Pond showing accumulated sludge at Dannhauser WWTW (Tweediedale Ponds)

Figure 12: Evidence of leaking from taxi rank public toilet conservancy tank (Dannhauser)

Figure 13: Durnacol WWTW with indication of required maintenance

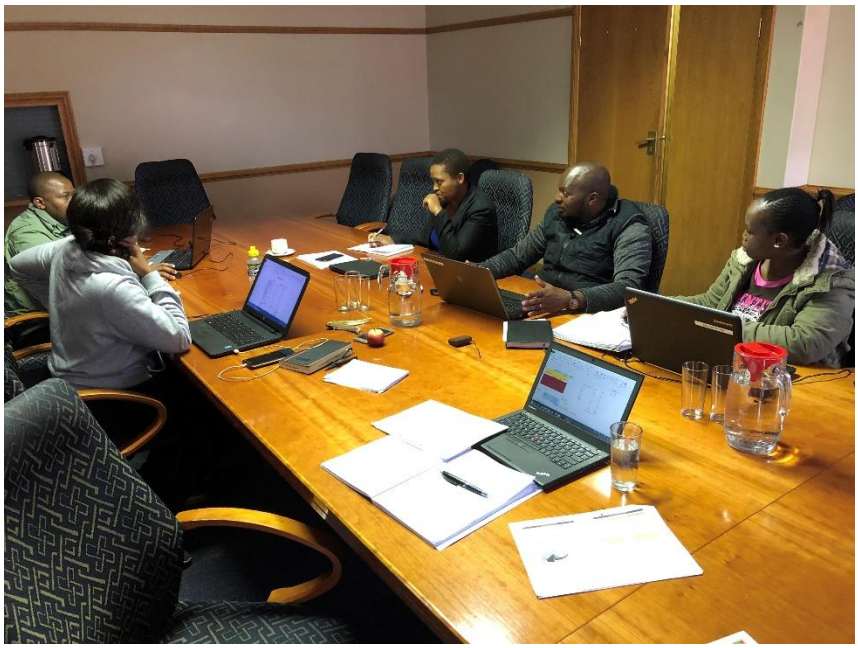

Figure 14: Data gathering, verification, analysis and interpretation with Amajuba DM team