Towards engaged solid waste management for cleaner cities and towns in South Africa

Technical report: Clean cities and towns: Understanding societal behaviour in order to reduce and divert waste going to landfills

Rinie Schenck, Charlotte Nell, Lizette Grobler and Derick Blaauw

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REVIEWED BY:		
Responsibility:	**Name:**	**Organization:**
Internal Reviewer	Dr Josephine Letsoalo	University of Limpopo
Internal Reviewer	Dr Takunda Chitaka	University of the Western Cape
External Reviewer:	Dr Marc Kalina	ETH Zurich

APPROVED BY (On behalf of issuing organisation):		
Name:	**Position:**	**Date:**

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EXECUTIVE SUMMARY

This document reports on the major findings from the DSI/CSIR Waste Roadmap-funded Clean Cities and Towns project, conducted by the SARChi Chair in Waste and Society between 2019 and 2021. This research project aimed to understand the perceived reasons for dirty cities and towns in South Africa and to generate constructive proposals to promote clean cities and towns. A multiple/collective case study design with mixed-method data collection and cross-case analysis was undertaken. Four towns in Category B municipalities (Drakenstein, Polokwane, Hantam and Kopanong) and one township in a Category A metro (Fisantekraal in the City of Cape Town) were selected to enable comparison between more and less serviced towns and areas. Selected townships with lower income status were focused on in each municipality as it was clear that these areas experience more problems with managing their waste than the more affluent areas do.

Quantitative data were collected through household surveys, household waste characterisation studies, illegal dumping mapping, and Buy Back Centre (BBC) feasibility studies. Qualitative data were collected through household interviews, interviews with taxi drivers, taxi commuters, train commuters, street vendors and key informants, as well as through fieldwork observations.

The main findings from the household surveys show that only two of the studied townships receive regular waste collection services; the majority of households either dump, bury or burn their waste because of a lack of sufficient waste management services. There is a shortage of waste receptacles, such as black bags and waste bins, and there is willingness to sort and recycle waste. Food waste is the only waste fraction reused as dog and pig food.

The household waste characterisation results show that the average waste generation ranged between 0.09 – 0.18 kg/capita/day. In all townships, food waste was the main contributor to the waste stream with an average generation of between 0.85 – 1.71 kg/household/week. This accounted for 20% - 52% of the waste composition in the target areas. In all areas, participants were willing and able to sort their waste into the required ten fractions and their sense of achievement was noticeable. All townships were different in the types and quantities of waste fractions generated, influenced especially by culture and dietary patterns. Participants indicated that they were not willing to keep used disposable diapers in or around the house for an entire week for them to be weighed as part of the household waste characterisation due to perceived or real health risks. As such the quantity of diapers generated in all target areas is assumed to be under-represented in the results.

The illegal dumping mapping revealed that even though the dumping of waste is labelled illegal, such dumping is not criminally motivated. When service delivery failures, such as non-removal of refuse, occur the waste management options for low-income residents without access to transport are limited. Thus, the one action that is within their power to take to manage their own waste is to dump their waste 'illegally'. Construction and demolition waste, diapers, bulky and garden waste fractions and dead animals seem to be problematic, particularly because of the lack of access to modes of transport. Supposed anti-dumping solutions, such as mini drop-offs or skips, become locations for dumping if not well managed, and so vandalising this infrastructure resource might be an expression of anger and frustration prompted by mismanagement. Criminal activities are not excluded.

Findings from two BBC feasibility studies both found that the major factors which make BBCs in the target towns (one in Kopanong Municipality and one in Hantam Municipality) not feasible is the limited quantity of recyclables available and the exorbitant transport costs. A traditional BBC where the BBC pays collectors for the recyclables will not be economically feasible. Innovative local solutions are needed, as well as the exploration of waste markets.

Interviews conducted with households, taxi drivers, taxi commuters, train commuters, street vendors and key informants with regard to the reasons for littering and illegal dumping could be grouped into ten major themes. The answers provided by the participants grouped in Theme 1 (personality traits), Theme 2 (not caring attitude), Theme 4 (ineffective and insufficient infrastructure), Theme 6 (lack of education and awareness) and Theme 10 (sanitation, litter and dumping) generate themes that occur in the literature globally. Theme 3 (non-caring government), Theme 5 (littering and dumping create jobs), Theme 7 (xenophobia), Theme 8 (no collaboration within communities) and Theme 9 (poverty and inequality) can be regarded as uniquely South African results. The 'uniquely' South African reasons, as expressed by the participants, relate directly to the broader South African context and fall within the characteristics/indicators of socially disorganised communities. Theme 10, making the link between sanitation, littering and dumping, reflects an international phenomenon which could be seen as indicating infrastructure challenges, but, as was highlighted in particular by those affected most and dependent on public ablution facilities (street vendors and taxi drivers and commuters), it is dealt with here as an additional theme.

Participants suggested ways in which littering and illegal dumping can be prevented. Suggestions could be grouped into the following themes: provision of services and sufficient waste infrastructure, collaboration with and within communities, creation of income-generating opportunities in communities, and increasing solid waste-related education and awareness.

It is clear that no single solution can address the wicked problems of waste and waste management, littering and dumping. Rodic and Wilson (2017) argue that, if waste management is not dealt with effectively, then at least 12 of the 17 United Nations SDGs will not be reached. A number of recommendations are highlighted that require waste management geared towards *engaged waste governance* or, in case of lack of service delivery from a municipality, towards *community-led service delivery* recognising the legal implications and possible enabling streamlined policy changes needed. SDG 16 (Peace justice and strong institutions) underpin engaged waste management which bind the institutions to the communities in which they operate.
In summary, the research highlight that local government can no longer be the only role player in waste management. The responsibility for clean environments must be shared and an engaged process where stakeholders hold each other mutually accountable, should be embraced.

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LIST OF ACRONYMS

BBC	Buy Back Centre
CA	Capability Approach
CDW	Community Development Workers
CE	Circular Economy
CoCT	City of Cape Town
CSIR	Council for Scientific and Industrial Research
DM	Drakenstein Municipality
DSI	Department of Science and Innovation
EPWP	Extended Public Works Programme
FHN	Fundamental Human Needs
HSD	Human Scale Development
HSSREC	Human and Social Science Research and Ethics Committee
NRF	National Research Foundation
NWMS	National Waste Management Strategy
PAR	Participatory Action Research
PETCO	PET recycling company
SC	Social Constructionism
SDG	Sustainable Development Goals
StatsSA	Statistics South Africa
SWM	Solid Waste Management
UL	University of Limpopo
UN	United Nations
UNEP	United Nations Environment Programme
UP	University of Pretoria
UWC	University of the Western Cape

Towards engaged solid waste management for cleaner cities and towns in South Africa

1 Introduction

Urban waste management is one of the major challenges facing cities in developing countries. It is evident that developing countries are struggling with the provision of effective waste management causing a threat to health, the environment and the well-being of urban residents. It also jeopardises the achievement of at least 12 of the 17 UN Sustainable Development Goals (SDGs) (Rodic & Wilson, 2017; UNEP, 2018) and a circular economy (CE) (Clube & Tennant, 2020; Schroeder, Lemille & Desmond, 2020). Many African cities are generating more waste than they can collect regularly and dispose of in environmentally sustainable ways because of fast-growing populations, poverty, unemployment, ineffective waste management by the municipalities and insufficient budgets (Godfrey & Oelofse, 2017; Godfrey et al., 2013; Jerie & Tevera, 2014).

South Africa is no different. However, Rodseth et al. (2020) add the unequally distributed wealth, infrastructure and service delivery to the South African context. Residents in rural municipalities typically receive fewer and inferior services than households in more affluent, urban municipalities. Factors, such as historical inequalities in the provision of support and services, the country's problematic political past, and high level of poverty, contribute to social disparity. Waste management, according to Rodseth et al. (2020:1), "in particular, illustrates this disparity". Kalina (2021) further confirms that a combination of societal attitudes and variations in waste collection systems in high-income and poor neighbourhoods account for the striking differences in the cleanliness of urban spaces. Structured formal waste collection is not always possible in some informal settlements and areas, and unequal delivery of waste services based on geographical location affects the social cohesion of communities. Olukoju (2018) notes that the efficiency and effectiveness of solid waste management serve as a barometer of good governance, as well as a measure to gauge the success of municipal management and urban reforms. According to Kirsten and Fourie (2021), South African municipalities are failing in providing sustainable services, including waste management.

This research aimed to understand the perceived reasons for dirty cities and towns in South Africa to be able to generate constructive proposals to promote clean cities and towns.

This report describes the results of data collected over a period of three years (2019-2021) in four towns in Category B local municipalities[1] in four provinces in South Africa, including a township linked to a Metro (Category A municipality).

[1] As directed by the South African Constitution, the Local Government: Municipal Structures Act, 1998 (Act 117 of 1998) contains criteria for determining when an area must be classified as a category A municipality (metropolitan municipalities) and when municipalities fall into categories B (local municipalities) or C (district municipalities) (SA Government 2022).

2 Description of concepts and theoretical frameworks

2.1 Defining concepts

This section discusses the concepts of solid waste management, pollution, littering and illegal dumping.

2.1.1 *Solid waste management*

Solid waste management refers to the collection, treating and disposing of solid material that has been discarded (Rasmeni & Madyira, 2019). In the South African context, the Constitution of South Africa (Act 108 of 1996) and the Municipal Systems Act, 2000, mandated municipalities to provide waste collection, disposal and cleansing services to all its residents. However, studies by Guerrero et al. (2012), UNEP (2018) and Kirsten and Fourie (2021) confirm that waste management is not only the responsibility of the local government, but also of private and public institutions, civil society, community organisations, education institutions, families and individuals – in fact, each and every person in the community. Figure 1 shows the multiple actors involved in a sustainable waste management system (UNEP, 2018).

Figure 1: Actors in waste management
Source: Adapted from UNEP (2018)

2.1.2 Pollution

Pollution in the broadest sense refers to the introduction of any harmful materials into the environment (UNEP, 2017). Globally, it impacts in excess of 200 million people and causes harm to ecosystems and wildlife (Chaudhary et al., 2021). Pollution includes air, water and soil pollution as a consequence of human activities. Waste mismanagement, such as badly managed or dumped and open burned waste, littering and illegal dumping, are forms of human activities that pollute.

2.1.3 Littering

Littering, as one of the most prominent types of pollution (Chaudhary et al., 2021), has been defined as the careless and improper disposal of small amounts of waste that results in unwanted and unnatural elements remaining in the environment (Al-Khatib et al., 2009; Khawaja & Shah, 2013; Ojedokun & Balogun, 2011). Littering is considered a global problem caused by human behaviour (Brown, et al., 2010; Marais & Armitage, 2004; Chaudhary et al., 2021). As with illegal dumping, municipalities worldwide pay millions to clean up litter and illegal dumping in public places and at public events (Garg & Mashilwane, 2015).

2.1.4 Illegal dumping

Illegal dumping is defined as the intentional and criminal abandonment of waste without a licence on unauthorised sites instead of disposing of waste at an authorised rubbish dump or landfill site (Liu et al., 2017; Lu, 2019). In terms of Section 27 of the South African National Environmental Management: Waste Act 59 of 2008, "No person may (a) throw, drop, deposit, spill or in any other way discard any litter into or onto any public place, land, vacant erf, stream, watercourse, street or road, or on any place to which the general public has access, except in a container or a place specifically provided for that purpose". In South Africa, reference is therefore made to this action as "illegal dumping".

A literature review on the concept illegal dumping, the following article is available.

Article:

Niyobuhungiro, R.V.&Schenck, C. J. (2022). A global literature review of the drivers of indiscriminate dumping of waste: Guiding future research in South Africa. *Development Southern Africa.* 39(3):321-337 https://doi.org/10.1080/0376835X.2020.1854086.

2.2 Theoretical approaches used in the study

In the social sciences, conducting research and the interpretation of the results are guided by theoretical frameworks. In this study the theoretical frameworks that assisted with guiding the research and with the analysis are outlined below.

2.2.1 Social Constructionism (SC)

The two most important premises of social constructionism are (i) that realities are socially and collectively constructed and (ii) that there is no autonomous reality to be discovered but instead we construct meaning through language (Schenck, 2019). We 'name' the world, as Freire (1998) would have put it. Critical in SC theory is that the way we construe realities determines the way we will act upon the constructed reality. The implication for this research process is that waste will be deemed a social issue and a social construct. How are waste, littering and dumping perceived and responded to by communities? Both Freire (1998) and Chambers (1997) propose that the research process starts with examining the constructions/realities of community members. Freire (1998) starts the research process with a consideration of the process of conscientisation[2], in which people share their lived experiences, reflect critically on their own realities and in the process discover how they think (e.g. about waste in this case), and find local solutions to their problems.

2.2.2 Amartya Sen's Capability Approach (CA)

Amartya Sen, a Nobel Prize winner in Economics, developed the CA. In summary, Sen believed that people's well-being depends on what they are capable of being and doing (freedom and opportunities) with the resources and facilities available to them. Capability improved with increased freedoms and opportunities (Nel et al., 2021). Freedom includes political freedom, economic facilities, social opportunities, transparency of and trust in the authorities, and protection for vulnerable people.

Poverty is viewed in the CA as capability deprivation. The focus of development will then be to remove barriers to freedom. This can include infrastructure improvements; decreased inequalities, social exclusion and discrimination; and the removal of restrictive policies.

2.2.3 Max-Neef's Human Scale Development (HSD)

Manfred Max-Neef was a Chilean economist who introduced the HSD framework to assist us as researchers and authors, such as Clube and Tennant (2020), to think more broadly than economics as the core to development. The HSD framework is a holistic system of interrelated fundamental human needs (FHNs), which are few and [3]finite and consist of a matrix with nine socio-universal fundamental human needs: subsistence, protection, affection, participation, understanding, idleness, creation, identity, and freedom. These are considered universally applicable and independent of culture. The FHN provides a lens through which to view and critique the currently neglected social component of a circular economy. For Max-Neef, poverty exists if any of the FHNs are not met and the well-being of the person is affected.

[2] The concept 'conscientisation' was used by Freire: It conveys the idea of developing, strengthening, and changing consciousness.

2.2.4 Social disorganisation theory

A theory used to explain littering and illegal dumping of waste is the social disorganisation theory. Authors, such as Tunnell (2008), Kamau (2016) and Brandt (2017), used social disorganisation theory to explain the drivers of illegal dumping. Social disorganisation theory refers to conditions in which the community institutions, values and culture have broken down (Kamau 2016). In contrast to social disorganisation, Tunnell (2008) refers to the concept of social control and Abdulai (2011) to concepts, such as social cohesion and collective efficacy, as important factors in preventing illegal dumping. A combination of socio-economic, political and infrastructural inequalities and injustices seems to be the root cause of social disorganisation. Illegal dumping occurs in communities displaying social disorganisation indicators: high mobility, migration and resident turnover, high rental prevalence, shortage of houses, high population density in the community and in the households, racial heterogeneity, rapid urbanisation (Hodsman & Williams, 2011) and the presence of crime (Croft et al., 2010).

3 Methodology

3.1 Introduction

A multiple/collective case study design with mixed methodologies was used to collect the data. According to Yin (2014), multiple cases strengthen the results by replicating the patterns and thereby increasing the robustness of the findings.

Case study research allows for in-depth insight, adds volumes of information and allows for eliciting rich data during the research process. Case study research ensures that the research subject is well explored, which accommodates multiple ways of expanding the exploration of a phenomenon, as well as the extent of information to be revealed and understood (Baxter & Jack, 2008).

Yin (2014) posits that case study research is an appropriate research strategy in which a contemporary phenomenon is to be studied in its natural context, especially when the boundaries between phenomenon and context are not clearly evident. In other words, a case study deliberately considers the contextual conditions - in this case, culture, background and socio-economic factors.

3.2 Sampling of the towns

According to the requirements of the research call, the towns selected had to be non-metropolitan area Category B towns (local municipalities). For the case study research four towns in Category B municipalities were selected to be able to make comparisons between more and less serviced towns and areas. The following townships in the four local municipalities were part of the study:

Drakenstein Municpality – Mbekweni and Paarl East

Polokwane Municipality – Mankweng and Matshelapata

Hantam Municipality – Calvinia West

Kopanong Municipality – Poding-tse-Rolo and Bergmanshoogte in Philippolis

One township outside the City of Cape Town, Fisantekraal, was also included in the study because the Faculty of Community and Health Science of the University of the Western Cape has a longstanding service-learning agreement with the community.

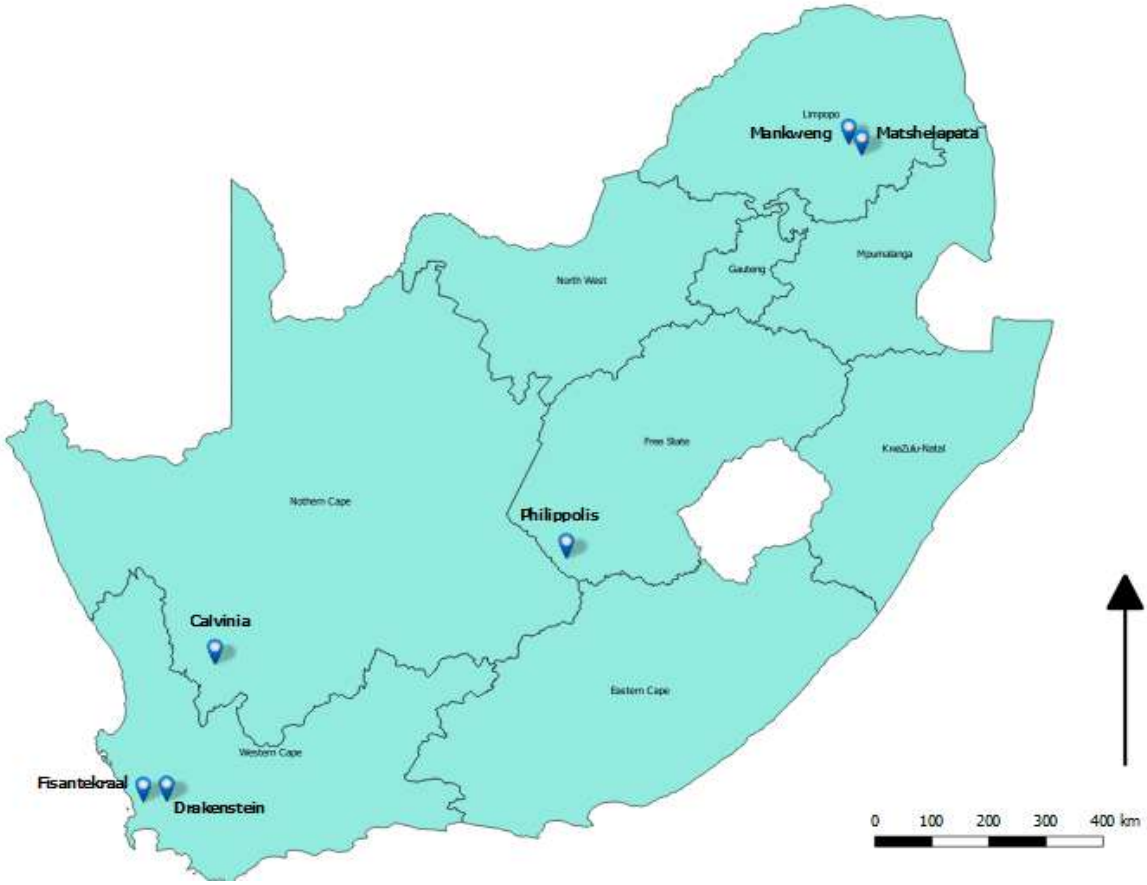

Figure 2: Study area map indicating the focus areas
Source: Alex Kimani

The townships selected were characterised by their lower socio-economic status within the municipalities, as it was clear that the residents in these areas experience more problems managing their waste than the more affluent areas did. All townships were characterised by high unemployment and grant dependency. The townships were selected because of the differences in waste management service delivery, which will be described briefly below.

3.2.1. Drakenstein Local Municipality (DM) – Mbekweni and Paarl East

In the Western Cape Province, where the Paarl East and Mbekweni townships are situated, Drakenstein Local Municipality is a well-functioning municipality with regular consistent weekly waste management. The households have access to piped water and sanitation. DM won the prize for being the cleanest and greenest city in the Western Cape Province in 2019. Both Mbekweni and Paarl East residents are provided with wheelie bins, and black bags are supplied on a weekly basis.

Historically, Mbekweni was initially developed as a black African residential township (Barry & Whitall, 2016). A large part of the population consists of first-generation urban residents and migrants hailing from

the Eastern Cape, while Paarl East is predominantly a Coloured community. In both areas, residents live in formal Reconstruction and Development Programme (RDP) houses. Backyard dwellings are often constructed behind the formal dwellings on the same erf, providing a source of income to the house owners in the form of rent. Often the home-owners themselves live in the backyard dwelling and rent out the RDP house to earn an even higher rental income. Paarl East is also known for crime and gangster activities (WCG, 2017).

3.2.2 Hantam Local Municipality – Calvinia West

In the Northern Cape Province, Calvinia was the selected town. Calvinia has regular weekly household waste removal, but no bins or bags are provided. The township Calvinia-West was the unit of analysis. Calvinia is situated about 400 km from other large urban centres, including Cape Town, Springbok and Upington. The percentage of formal dwellings was recorded at 97%. In terms of service delivery, 80,5% had flush toilets connected to sewerage, 65,2% had access to piped water inside dwellings, and 97,4% received weekly refuse removal.

3.2.3 Kopanong Local Municipality – Poding-tse-Rolo and Bergmanshoogte in Philippolis

Philippolis is the oldest town in the Free State Province in South Africa. The Kopanong Municipality ranks as the most sparsely populated municipal area in the Free State Province. Despite the fact that Kopanong municipality's IDP claims good provision of housing and services, recent media reports confirmed that Philippolis, along with other rural towns in the Free State province, are challenged in terms of service delivery (Kopanong Local Municipality, 2021). Consequently, local communities have attempted to deal with water provision, waste management and recycling issues themselves. Residents from Philippolis have conducted waste dumpsite clean-ups and also cleaned the entrances to the town. At the time of the study, because of Kopanong Municipality's non-payment of their water bill to Bloemwater (the major water provider), households had access to water only for a few hours per day. At the time of writing of this report the Kopanong Municipality was able to receive only 30% of its water from Bloemwater as a result of non-payment, despite the fact that the Gariepdam was overflowing after a good rainy season. No bins or bags are provided to the households to assist with waste removal.

Philippolis consists of three distinct areas. Two areas, Bergmanshoogte and Poding-tse-Rolo, were included in the study. In 2007 the population was recorded as 6 000, while the 2011 census statistics indicated only 3 648 people in the town (StatsSA, 2012). However, in contrast to the 2011 census statistics (StatsSA, 2012), there has been a growth in the townships and, as Nel et al. (2011) rightly observe, small towns in South Africa experience a declining white population, but growth in the black and coloured populations. According to Nel et al., (2011:408), the lack of employment opportunities has now made these small towns the "locus of a significant concentration of unemployment, poverty and welfare dependence".

3.2.4 Polokwane Local Municipality – Mankweng and Matshelapata

In the Polokwane Local Municipality, the capital of the Limpopo province, two areas formed part of the research. Matshelapata, a rural village, was chosen as it does not have any waste removal services. Matshelapata is a small village located 50 km from Polokwane. The residents are black Africans and mostly Sepedi speaking. Although the community has access to piped water, during the researchers' visit water was delivered to the houses by truck not only because of the drought in the area, but also the declining

maintenance of the water-provision system. In addition to the political ward councillor, the village is still under the traditional rule of an Nduna[4] and a Chief.

Adjacent to Matshelapata is Mankweng township, the economic hub of the area. Mankweng developed in the 1960s around the University College of the North (now University of Limpopo) and is the most populous cluster within Polokwane Municipality. As a fast-growing community, Mankweng is characterised by overburdened infrastructure and service-delivery challenges. Observation of the township's transportation infrastructure (roads and taxi stands) confirmed problems with waste management and, in particular, littering. The municipal waste manager also shared that more and more people living in Polokwane city are now moving to Mankweng as a result of non-payment of rates and taxes and a preference to provide their own infrastructure. Boreholes are being sunk and waste removal privately managed and paid for, as the inhabitants do not trust the municipality to deliver equal services to the Mankweng township and Polokwane City.

3.2.5 Fisantekraal

Fisantekraal was chosen as an additional research setting. One of the reasons is that the Faculty of Dentistry and the Faculty of Community and Health Sciences of the University of the Western Cape (UWC) are involved in Fisantekraal as a service-learning site for their students. There is already a relationship between the community of Fisantekraal and UWC. The second reason for selecting Fisantekraal as a research site is that it is a separate ward and 8 km away from the next residential area or ward (Durbanville) and, unlike other suburbs, Fisantekraal is a unit on its own. The third and main reason is the high prevalence of illegal dumping in Fisantekraal. Fisantekraal is a densely populated township within the City of Cape Town (CoCT). According to the 2011 census, it had a population of 12 369 people (Stats SA, 2011). The 2011 national census reported that Fisantekraal was composed of various ethnic groups, including Blacks (51.6%), Coloureds (46.9%), and others (foreign nationals) (0.16%).

From the history of Fisantekraal, it is evident that this residential area can be regarded as a socially disorganised community. Burgoyne (2008) points out that during the 1990s, homeless people invaded one of the farms, because of a need for low-cost housing in the area for farm workers, domestic workers and labourers required for new developing businesses in the area. The CoCT referred to the development as a 'rural node' and started planning for affordable low-cost housing in Fisantekraal in 1996. Construction started in 2000. It is important to note that right from the planning phase, there were racially and politically driven conflicts, protests and home invasions (Burgoyne, 2008). Originally, 1 600 formal houses were delivered in Fisantekraal, but then an informal settlement developed adjacent to the formal area. The first observation of this area is that the largest area is informal and densely populated. Fisantekraal is expanding with new housing developments established as mentioned above.

Despite the regular weekly waste removal by the CoCT, illegal dumping is a regular occurrence in the township.

Note: It is important to note that the study in Fisantekraal was a unique independent study which will be reported on in the study

[4] Nduna refers the headman or leader

Table 1: Summary of the townships studied

Name of Category B Local Municipality	**Focus areas**	**Level of waste management service rendered (2019-2021)**
Drakenstein	Mbekweni and Paarl East	Weekly door-to-door waste collection by the municipality. Daily mini drop-off waste collection by the municipality.
Hantam	Calvinia West, Calvinia	Weekly door-to-door waste collection by the municipality.
Kopanong	Poding-tse-Rolo and Bergmanshoogte, Philippolis	Weekly door-to-door waste collection by municipal workers and trucks, if and when available, alternatively by local residents. Collection services funded by the Philippolis Concerned Citizens group as a result of bankrupt municipality.
Polokwane	Mankweng and Matshelapata	Mankweng: Waste removal privately done. Matshelapata: No waste collection services rendered by the municipality.
Category A Municipality		
City of Cape Town	Fisantekraal	Weekly waste removal.

Source: Research data

3.3 Data collection

An exploratory case study research design with a mix of quantitative and qualitative data-collection methods was used to build the case studies (Creswell 2013). The data were collected between 2019 and November 2021. During 2020 and 2021 the data were collected between the waves of COVID-19 outbreaks.

3.3.1 Quantitative data collected

1. Household surveys

Questionnaires determining household waste perceptions and behaviour were conducted. The questionnaires consisted of a combination of closed tick-box and open clarification questions. A total of 877 questionnaires were completed in the selected townships.

2. Household waste characterisation studies

Five-week household waste characterisation studies, analysing the waste generated by 230 households, were conducted. The details of the process are discussed in the results section. An article published on the results in one of the towns can be found at:

Article
Nell, C., Schenck C.J., Blaauw, P.F., Grobler, L. & Viljoen J.M.M. 2022. A three-pronged approach to waste composition determination. *Journal of Environmental Management.* 303(2):114203. http://dx.doi.org/10.1016/j.jenvman.2021.114203

3. Illegal dumping mapping

All illegal dumpsites were mapped in each township. Maps were made using ArcGIS software (Kimani, 2021). Geospatial data were collected by making use of the mobile application *Field Area Measure.* Coordinates and the size of each illegal dumpsite were captured. The types of waste in/on the dumpsites were recorded and listed. Photos were taken of each illegal dumpsite.

4. Buy Back Centre studies

Structured interviews were conducted with Buy Back Centre (BBC) owners in the participating towns. In Philippolis there is no BBC; Calvinia has three scrap-metal dealers – only 2 were interviewed as one refused to be interviewed; in Mankweng two BBC owners were interviewed, which included the major BBC owner in Polokwane to whom most of the smaller BBCs deliver. Two BBC owners in Drakenstein Municipality were interviewed.

5. Buy Back Centre feasibility studies

In Mankweng and Drakenstein there are BBCs that buy recyclables from waste pickers and the public. In Calvinia the scrap-metal dealers buy scrap, steel and aluminium (alu) tins from the residents. There is no BBC collecting and buying recyclable waste except for 'Tannie M' (Auntie M), who collects glass, steel and alu tins from the landfills. Philippolis had a BBC a few years ago which failed.

Since the community expressed a desire for BBCs and the possibility of recycling as a potential source of income, we collaborated with Prof. Johan Joubert from the Industrial Engineering Department at the University of Pretoria (UP) to conduct feasibility studies for BBCs in Calvinia and Philippolis. Two 4th level students conducted the studies as part of their final year projects.

The report of the Calvinia study is attached as:

Addendum B:
Pieterse, C. (2021). *The financial sustainability and operations design of a potential recycling buy-back centre in Calvinia.* Mini dissertation for BSc Industrial Engineering, University of Pretoria. Pretoria.

3.3.2 Qualitative data

1. Household interviews

In total 322 semi-structured open-ended interviews exploring perceptions of the reasons for littering and illegal dumping were completed with one member per household. The following interviews were completed until data saturation was reached in each of the areas:

Table 2: Number of households interviewed

Mbekweni	Paarl East	Calvinia	Philippolis	Matshelapata	Total
40	91	73	70	48	322

Source: research data

2. Taxi drivers and commuters

In the central business districts of DM (Paarl and Wellington) and Polokwane Municipality (Mankweng), semi-structured questionnaires were used to interview taxi drivers while they were waiting in the queue for passengers and commuters waiting to be picked up. Philippolis and Calvinia do not have taxi ranks. Individuals in Calvinia who own taxis have their own operating system. A total of 71 taxi drivers and 120 taxi commuters available and willing to participate in the study were interviewed in both areas until data saturation.

3. Train commuters

DM is the only municipality where there is still an operating train service. The remaining three towns selected for the study no longer have working train stations as a result of the deterioration of the South African railway system after 1994 to the point that the railway network is likely to be written off (Williams, 2021). The data were collected during October 2019. The reason for interviewing train commuters was that the municipality indicated that the taxi ranks and the train station were regarded as litter hotspots.

A total of 21 commuters participated. The following article provides full details of the results:

Article
Schenck, C. J., Grobler, L., Blaauw, P. F. & Viljoen, J.M.M. (2021). Commuters' Perceptions of Littering on Trains in South Africa: A Case for Environmental Social Work provides a detailed account of this aspect of the research. *Southern African Journal of Social Work and Social Development.* 33(3). https://doi.org/10.25159/2415-5829/9951.

4. Street vendors

Semi-structured interviews were conducted with 92 street vendors in the central business districts (CBDs) and taxi ranks of Mankweng and Paarl. Neither Philippolis nor Calvinia have regular street vendors. In

Philippolis street vendors were found selling products only at the end of the month when salaries and grants are paid. In Calvinia only two foreigners were selling products. Both refused to be interviewed. The results are described in the following article:

Article
Schenck, C. J., Grobler, L., Viljoen, K., Blaauw, D. & Letsoalo, J. (2021)**.** Double Whammy Wicked: Street Vendors and Littering in Mankweng Township and Paarl, South Africa—Towards People-centred Urban Governance. *Urban Forum.* https://doi.org/10.1007/s12132-021-09455-3

5. Key informants

Key informants in the communities were interviewed, such as the local waste managers, municipal manager, members of business chambers, ministers of religion, NGOs, interested people, teachers. In Philippolis the researchers were not afforded the opportunity to conduct an interview with either the waste manager, the councillor elected in Philippolis, or the municipal manager, despite multiple attempts to do so during all visits.

6. Observations

Observations were made and photos taken while mapping the illegal dumpsites and conducting the household waste characterisation study. Permission to take photos was always obtained when people were involved. Permissions to take photos of the landfill sites were obtained from the municipalities – except in Philippolis.

3.3.3 Additional studies

1. Mbekweni and Paarl East mini drop-off study

Additional project funding was obtained from the International Union for the Conservation of Nature (IUCN) to conduct and evaluate the use of mini drop-offs as a way to curb illegal dumping in DM. Reference is made to this study in the discussion of the results.

The full report is available at:

Report

Schenck, C.J., Grobler, L. & Tyrrell, H. (2021) *Managing waste in lower-income communities by formalizing illegal dump sites: Learnings from Drakenstein Municipality* International Union for the Conservation of Nature (IUCN). Available at

https://www.researchgate.net/publication/355586461_Managing_waste_in_lower-income_communities_by_formalising_illegal_dump_sites_Learnings_from_Drakenstein_Municipality

2. Fisantekraal

The results in this study are derived from a participatory action research (PAR) project (2019-2021) to map the illegal dumpsites in Fisantekraal over a period of 9 months and to determine the reasons for indiscriminate dumping in Fisantekraal.

The dumpsites were visited on 31 July 2019, 20 September 2019 and 10 January 2020. Seventy-nine (79) residents, community leaders, teachers and shop owners were interviewed using semi-structured interviews and in two focus group discussions.

3.4 Member checking

During October and November of 2021 all towns were revisited and feedback given to the stakeholders and interested parties. In DM, feedback was given to the municipality and waste management team. Similarly, in Calvinia and Polokwane results were shared with the waste management teams and interested individuals. In Philippolis, 30 interested community members attended the session.

3.5 Fieldworkers: Students and residents

To collect the data, the services of trained postgraduate students from the University of the Western Cape (UWC) and the University of Limpopo (UL) were used. Data were also collected by trained unemployed residents residing in the townships, also referred to as participant researchers. The benefit of their paid assistance was two-fold: they enabled easy access to the communities and enhanced the credibility of the research process among the residents of the townships. In addition to developing skills, the project's financial support also established goodwill in the community.

3.6 Ethical considerations

The Human and Social Science Research and Ethics Committee (HSSREC) of the University of the Western Cape approved the research project.

4 Results

In this section the main results of the different studies will be described.

4.1 Results: Perceptions and experiences of waste management in the townships

This section conveys the main insights gained from a questionnaire to provide an overview of the socio-economic status of the residents of the townships as well as perceptions of waste management and waste behaviour in the respective townships. The aim of the study was to determine the perceptions and experiences of the residents regarding waste management services delivered by their respective municipalities, which served as background to the other data collected.

4.1.1 Types of dwellings of respondents

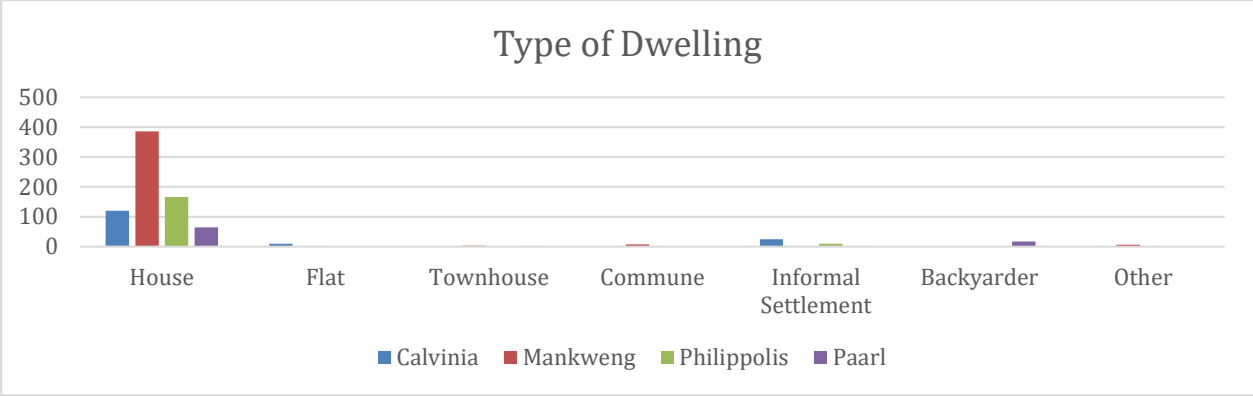

Figure 3: Type of dwelling in which the respondents reside
Source: Research data

The vast majority of respondents (736) interviewed were reported to live in formal RDP houses (88.7%), with the next highest category being informal settlements (4.7%). It is to be noted that the majority (89.7%) of respondents living in informal settlements lived in either Calvinia (64.1%) or Philippolis (25.6%). All 17 respondents reported to be 'backyarders' were from Mbekweni (Paarl). According to the 2020 Household survey of Statistics South Africa 84% of South Africans have access to formal housing (StatsSA, 2021).

4.1.2 Number of people residing in the household in the four municipalities

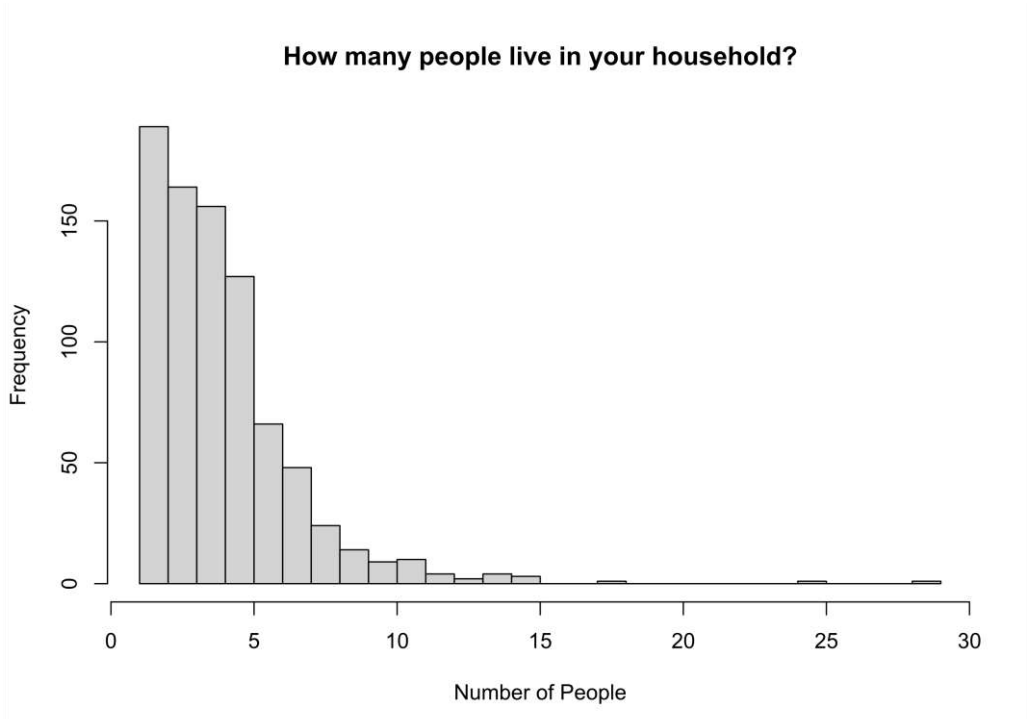

Figure 4: Number of people residing in the household in the four municipalities (N=823)

Source: Research data

Table 3: Average number of people living in the households in the four municipalities

Min.	1st Qu.	Median	Mean	3rd Qu	Max
1	3	4	4.344	5	29

Source: Research data

The average household size was 4.344. There were, however, a few outliers as can be seen in Figure 4 – very large households with occupants up to 29 per household were found. On further investigation these were almost exclusively student accommodation/shared living spaces in Mankweng – next to the University of Limpopo – or households in Mbekweni (Paarl) who counted their backyard dwellers as part of the household. As will be seen later, the density of the living space has an impact on the waste management for the owner and tenants.

A lesson learned from this question was that the questionnaire should make provision for backyarders and tenants.

4.1.3 Income range of households

Precise monthly household income was not requested. Instead respondents indicated a range into which their household income fell, using Table 4.

Table 4: Question to determine income ranges

No income	1
R1 - R400	2
R401 – R800	3
R801 - R1 600	4
R1 601 - R3 200	5
R 3 201 - R6 400	6
R 6 401 - R12 800	7
R12 801 - R25 600	8
R25 601 – R51 200	9
R51 201 – R102 400	10
R102 401 – R204 800	11
R204 800 or more	12

These values were used to generate the horizontal axis on the associated histograms.
The following tables provide the income details of the residents of the four townships:

Table 5: Average income in Calvinia

Min	1st Qu	Median	Mean	3rd Qu	Max
R1,000	R5,000	R6,000	R5,783	R7,000	R10,000

Source: Research data

Table 6: Average income in Mankweng

Min	1st Qu	Median	Mean	3rd Qu	Max
R1,000	R4,000	R6,000	R5,794	R7,000	R12,000

Source: Research data

Table 7: Average income in Philippolis

Min	1st Qu	Median	Mean	3rd Qu	Max
R1,000	R3,000	R4,000	R3,657	R5,000	R8,000

Source: Research data

Table 8: Average income in Mbekweni (Paarl)

Min	1st Qu	Median	Mean	3rd Qu	Max
R1,000	R4,000	R5,000	R4,718	R6,000	R7,000

Source: Research data

Philippolis (Bergmanshoogte and Poding-tse-Rolo) residents are indeed the poorest, but it seems that Calvinia and Mankweng are about tied for better income, both in terms of the median and the mode. Paarl does not have many very poor households, but it also has no very rich households. An explanation for the better income for Calvinia is that Calvinia is a hub for government departments in the Northern Cape and Mankweng is next to the University of Limpopo, and other government departments are also present. Mankweng is also the economic hub of the area. Philippolis is isolated and people are dependent on farming activities and grant incomes.

4.1.4 Practices regarding handling of waste in three towns

Table 9 summarises respondents' practices regarding the storage of waste before it is removed.

Table 9: Storing of household waste

	Number of respondents			
	Calvinia N=161	**Philippolis N=181**	**Mankweng N=450**	**Mbekweni N=86**
Black bags	61	86	151	24
Recycling bags (orange/ white/ green/ transparent	1	2	1	0
Municipal bin	8	4	15	76
Other	82	83	235	0

Source: Research data

Storage of waste in recycling bags is a rare phenomenon in all the townships. None of the townships were involved in recycling initiated by the municipalities. The results confirm that Mbekweni in DM is the only township where residents receive wheelie bins to store their waste. In Calvinia, households keep smaller waste in bins inside the house until the bin is full. It will then be stored in reused oil drums (see Figure 5) which they source from farmers. In Mankweng the waste is kept in shopping bags inside their houses until

it is burnt, buried or dumped. In Philippolis the majority of households indicated that they store waste in maize-meal bags (see Figure 6) as they are strong and not easily ripped by dogs and pigs when put out for collection. When we drafted the questionnaire we did not foresee that the provision and/or buying of black bags is a rarity in townships. Participants also clearly stated that they cannot afford to buy black bags and therefore use either shopping bags and/or maize-meal bags. We also observed empty dog/animal feed bags used for storing waste.

Figure 5: Steel drums as waste storage in Calvinia
Source: Researchers

Figure 6: Maize meal bags used in Philippolis
Source: Researchers

The best indication of recycling and re-use of household waste was obtained when respondents were asked to indicate what happens to specific categories of waste generated in their household – see Table 10. In Philippolis, except for food, only around 11% of all household waste is put out to be collected by the municipality. Only two respondents mentioned that old clothes are donated for charity, but apart from that, most household waste is dealt with in other ways. The responses are an indication that communities are left with very few formal options to handle waste. The remaining 89% of waste is either burnt or dumped. Of the four towns, Philippolis is the only one where almost all households indicated

that food waste is used as animal food. Most respondents use it as pig food, followed by feeding dogs and chickens.

In Table 10 respondents share how they handle the different waste categories

Table 10: Management of the different categories of waste

	Paper	Plastic	Clothes	Electronics	Glass	Batteries	Food
	Number of responses from **Calvinia**						
Put in black bags for collection by municipality	85	87	37	77	84	85	48
Separate bags for reclaimers	2	0	1	0	0	0	1
Give to charity	1	0	40	3	0	0	3
Give to school or church	0	0	0	0	0	0	1
Take to drop-off centre	0	0	0	1	0	0	0
Other	58	59	68	65	62	59	91
	Number of responses from **Philippolis**						
Put in black bags for collection by municipality	21	21	17	17	20	18	14
Separate bags for reclaimers	0	0	0	0	0	0	0
Give to charity	0	0	2	0	0	0	0
Give to school or church	0	0	0	0	0	0	0
Take to drop-off centre	0	0	0	0	0	0	0
Other	151	151	151	151	151	149	154
	Number of responses from **Mankweng**						
Put in black bags for collection by municipality	116	115	41	74	113	97	106
Separate bags for reclaimers	9	18	10	4	9	4	4
Give to charity	3	0	98	3	1	1	0
Give to school or church	0	1	9	2	1	0	1
Take to drop-off centre	1	1	0	7	8	6	1
Other	266	264	233	246	224	227	280
	Number of responses from **Mbekweni**						
Put in black bags for collection by municipality	85	19	75	2	3	0	0
Separate bags for reclaimers	0	4	5	14	17	18	6
Give to charity	0	0	14	1	0	0	0
Give to school or church	0	0	4	2	1	1	0
Take to drop-off centre	0	0	0	1	2	1	0
Other	0	0	0	0	0	1	16

Source: Research data

Comparing the four towns, the following was observed: In Calvinia and Mbekweni the largest amount of household waste was deposited in bags for municipal removal as they have regular waste removal

services. In Mbekweni, Calvinia and Mankweng, used clothes are donated to charities. Only two persons in Philippolis indicated donating clothes. Regarding other ways of disposing of waste, the majority of households indicated that they put all kinds of waste together in one bin. Residents also mentioned the re-use of food as pet food, particularly dogs, but not to the same extent as reported in Philippolis and Mbekweni.

Even though the Mankweng residents, similar to Philippolis, mostly employ ways other than municipal services to dispose of waste, they also recycle. It is the one town where all kinds of recyclable items are put out in separate bags to be collected by informal waste reclaimers. Apart from displaying the willingness of the residents to recycle, it also indicates that there is a demand/ market for recyclable material. This observation is further enhanced by reports that respondents themselves do take items to drop-off centres.

Note: It is important to note is that among the 'other' ways described to dispose of waste, dumping, burying and burning are reported *("People dump waste everywhere." – "Diapers are everywhere.").*

The re-use of food as pet food, however, has the lowest incidence in Mankweng.

Figures 7-11 indicate the regularity of waste collection as experienced by the residents of the four townships.

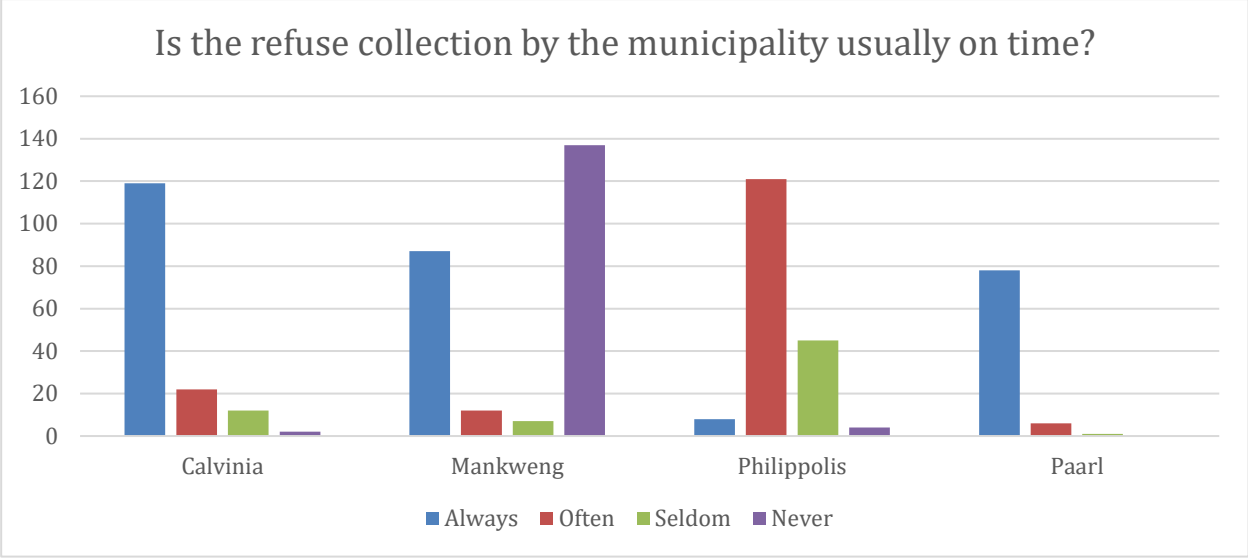

Figure 7: Regularity of waste removal in the four townships (N=661)

Source: Research data

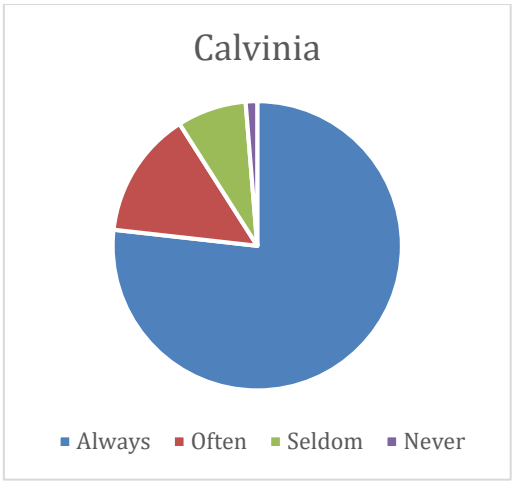

Figure 8: Regularity of Calvinia waste collection

Figure 9: Regularity of Mankweng waste collection

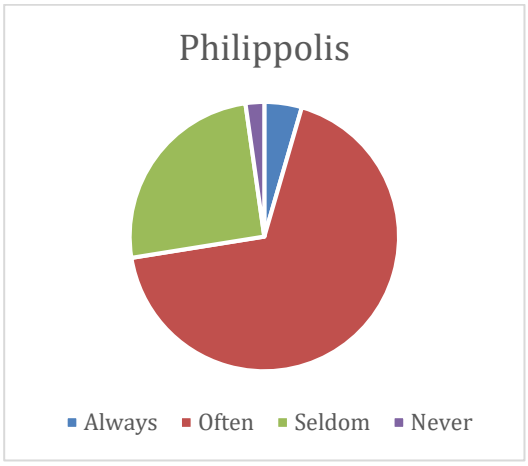

Figure 10: Regularity of Philippolis waste collection

Figure 11: Regularity of Paarl waste collection

The areas in order of waste collection punctuality were Mbekweni (Paarl), Calvinia, Philippolis, Mankweng. Mankweng was the only area in which a substantial share of respondents (56.4%) reported that waste collection was “never” on time. However, Mankweng did also have a substantial share of respondents (35.8%) reporting that collection was “always” on time as there are areas who fall within the waste collection plan of the municipality. Philippolis had by far the lowest share (4.5%) of respondents reporting that collection was “always” on time.

Mbekweni (Paarl) and Calvinia have regular weekly waste removal, and the residents confirmed the regularity of the waste removal services, while Philippolis residents clearly showed that there is supposed to be a service, but the service delivery is not regular. It is currently managed by a concerned group of citizens, if and when they have sufficient resources. Some parts of Mankweng (Polokwane) have no waste removal, although there are sections that form part of the weekly waste removal services. Interesting is the fact that just under half (43,7%) of the residents in Mankweng did not answer this question at all, whereas this question was well answered in the other towns. Of the 661 residents who answered the question, 52,8% receive regular, weekly waste removal services – which is lower than indicated in the 2020 Household survey of StatsSA 2021 (60,5%)

4.1.5 Willingness to participate in recycling

Table 11: Reported willingness to participate in recycling

	Calvinia			Philippolis			Mankweng			Mbekweni		
	Sort	**Bags**		**Sort**	**Bags**		**Sort**	**Bags**		**Sort**	**Bags**	
Yes	89.9	95.3		93.1	94.9		84.5	86.8		91.9	91.1	
No	10.1	4.7		6.9	5.1		15.5	13.2		8.1	8.1	

*Percentage of respondents providing either a "yes" or "no" answer

Source: Research data

As illustrated in Table 11, 93.1% of residents in Philippolis indicated their willingness to participate in separation at source, followed by 91.9% in Mbekweni (Paarl), 89.9% in Calvinia and 84.5% in Mankweng (Polokwane). With 95.3% and 94.9% of residents in Calvinia and Philippolis respectively answering "yes" to the question on the use of different bags for different categories of waste, there is an eagerness to recycle. As will be seen in the next set of results of the waste characterisation study, the willingness to participate in separation at source was confirmed. The participants expressed a sense of achievement after the fieldworkers weighed and counted the waste collected.

The articles referenced here provide more insight into residents' recycling behaviour in Paarl (Drakenstein municipality) and residents' waste management practices in Calvinia (Hantam municipality).

Articles

Volschenk, L., Viljoen, J.J.M. & Schenck, C. (2021). Socio-economic factors affecting household participation in curbside recycling programmes: Evidence from Drakenstein municipality, South Africa. *African Journal of Business and Economic Research,* 6(1):143-162. Available at https://hdl.handle.net/10520/ejc-aa_ajber_v16_n1_a6

Viljoen, J.J.M., Schenck,C.J., Volschenk, L., Blaauw, P.F. & Grobler, L. (2020). Household waste management practices and challenges in a rural remote town in the Hantam Municipality in the Northern Cape, South Africa. *Sustainability,* 13(1):5903. https://doi.org/10.3390/su13115903.

4.1.6 Summary of the results

1. Only Mbekweni and Calvinia receive regular waste collection services but, with the exception of Mbekweni, the majority of the households dump, bury or burn their waste because of a lack of sufficient and appropriate waste management services and other options to manage their waste.
2. Food waste is the only waste fraction that is reused as dog and pig food.
3. There is a shortage of waste receptacles, such as black bags and waste bins. Only Mbekweni residents are supported with bins and bags (which are stolen and used for other purposes). This is also the case in Fisantekraal. However, the bins and bags do not make provision for the backyarders and informal housing. Residents in Calvinia and Philippolis have to provide their own receptacles for storage of waste.
4. There is a willingness to sort and recycle waste.

4.2 Results: Household waste characterisation study

A household waste characterisation study was conducted in each of the four townships. The aim of the waste characterisation study was to determine the household waste composition for each area, as well as the waste generation rate per capita. We wanted to understand what kinds of waste are generated in each of the areas and how the residents deal with the different waste fractions. The research process also allowed us to engage with the community and develop a better understanding of their socio-economic circumstances, over and above the waste they generated and managed.

The methodology followed to generate these data is outlined below.
Trained fieldworkers recruited a select number of households from target suburbs in each town. During the recruitment phase, fieldworkers were tasked to do the following:

1. Introduce themselves;
2. Introduce potential participants to the project and indicate that the work will be done with the University of the Western Cape;
3. Explain that there will be a mandatory training session that will need to be attended in order to qualify for participation;
4. Should the participant be willing to take part, write down their contact details and address. Explain that these details will not be circulated but that it is important to have them as weighing of waste would likely take place at their homes, or close to their homes.

At the mandatory training session, hosted by the lead researcher and team, attendees were familiarised with the project (Figure 12) and received a 'waste characterisation starter kit' (Figure 13).

Figure 12: Matshelapata residents at the training session March 2020

Source: Researchers

Figure 13: Waste characterisation 'starter kits' for each household
Source: Researchers

The kit consisted of one plastic bucket with a lid, eight plastic bags, one envelope and a sorting guide (Figure 14 see below), available in one of four languages (English, Sepedi, isiXhosa or Afrikaans).

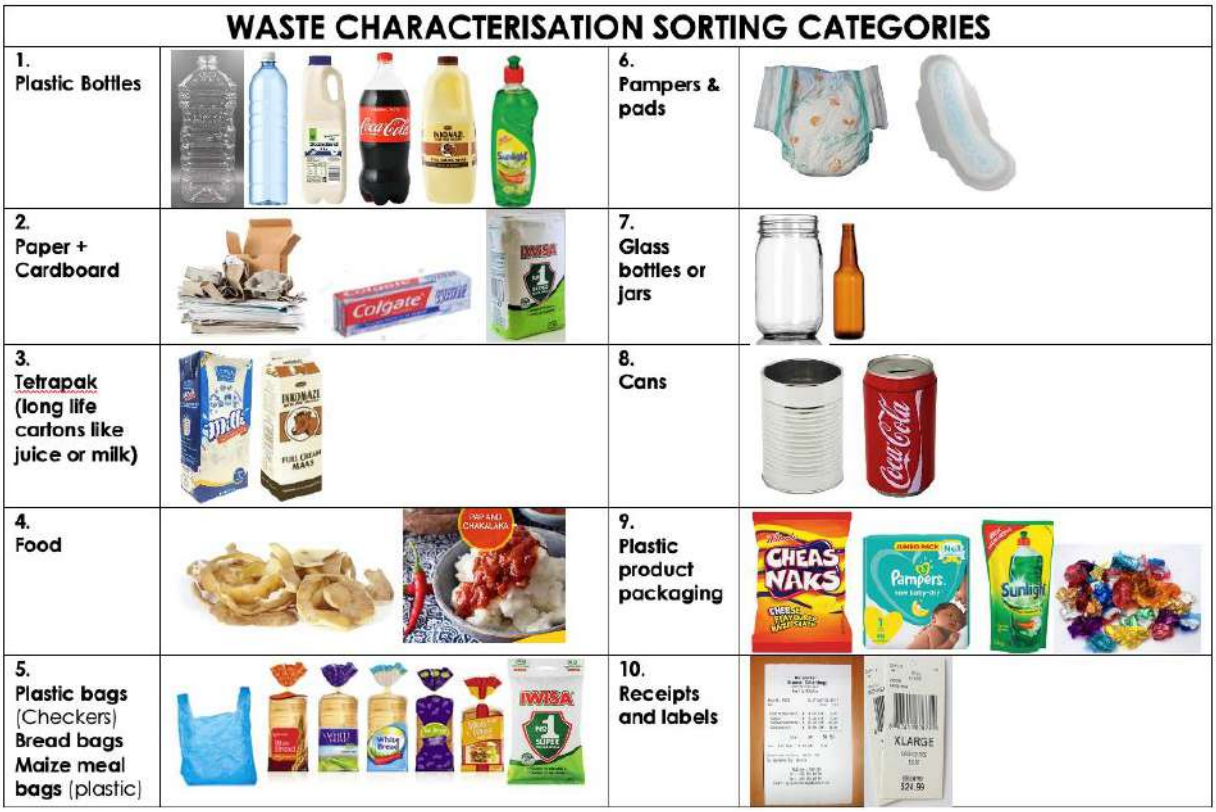

Figure 14:Waste characterisation sorting categories
Source: Charlotte Nell

Households were invited to raise any queries or concerns during the training session and were given the opportunity to retract their offer of participation should the study no longer interest them after the training. During the training, each house was given a specific number for the duration of the study (e.g. house Number 1, house Number 2, etc.). A questionnaire was also filled in for each house either at the training session, or in the week that followed (see Appendix A).

The following table shows the number of households taking part in the study per town and target suburb, as well as the duration of the study (Table 12: Details of the various waste characterisation studies):

Table 12: Details of the various waste characterisation studies

Town	Target area (suburb)	n (households)	Study duration	Weighing dates
Calvinia	Calvinia-West	50	4 weeks	1. 19 November 2020 2. 26 November 2020 3. 3 December 2020 4. 10 December 2020
Philippolis	Poding-tse-Rolo	50	5 weeks	1. 19 March 2021 2. 26 March 2021 3. 31 March 2021 4. 9 April 2021 5. 16 April 2021
	Bergmanshoogte	30	5 weeks	1. 18 March 2021 2. 25 March 2021 3. 1 April 2021 4. 8 April 2021 5. 15 April 2021
Paarl	Groenheuwel	60	5 weeks: Attempt 1	1. 15 and 17 June 2021 2. 22 and 24 June 2021 3. 29 June and 1 July 2021 4. 6 and 8 July 2021 4. 13 and 15 July 2021
		46	4 weeks: Attempt 2	1. 3 and 5 August 2021 2. 10 and 12 August 2021 3. 17 and 19 August 2021 4. 24 and 26 August 2021
Mankweng	Matshelapta	50	1 week: Pre-lockdown	1. 20 March 2020
		50	4 weeks: Post-lockdown	1. 11 September 2020 2. 18 September 2020 3. 25 September 2020 4. 2 October 2020

Source: Research data

In Calvinia, 50 households in the Calvinia West suburb participated in the waste characterisation study for a duration of 4 weeks. In Philippolis, two studies were conducted, one in Poding-tse-Rolo and one in Bergmanshoogte, with 50 and 30 households respectively taking part for a period of 4 weeks each. In Paarl, 60 Groenheuwel households participated for a period of 5 weeks in June/July of 2021. However, when the data generated by the fieldworkers were analysed, it was found that one of the fieldworkers had clearly fabricated the data. Unfortunately, none of the data could be used and the study had to be redone. Of the original 60 households that participated, 46 households agreed to form part of the study for another 4-week period. In Matshelapata, 50 households formed part of the study. Matshelapata

residents started the study a week before lockdown was announced in South Africa (on 26 March 2020) because of the COVID-19 pandemic. Thus the study had to be halted after the first weighing – and was restarted from scratch in September 2020 with some pre-lockdown committed households falling away and new households filling the gaps. As such, another mandatory training session was held and new starter kits distributed where required. All results shown for Matshelapata include only the data collected during the 4-week post-lockdown study and exclude data captured on 20 March 2020.

A collaborative approach to waste characterisation was adopted in that households were asked to divide their household waste themselves, according to the circulated guide (Figure 14). Households were strictly instructed not to collect purposefully any waste materials not directly generated within the house, such as litter, as this was not a clean-up exercise. Trained data capturers visited each household once per week to weigh the waste and to complete a spreadsheet with the following columns:

1. Plastic bottles - weight (kg)
    a. How many 500 ml or smaller
    b. How many 750 ml
    c. How many 1 litre
    d. How many 1.5 litre
    e. How many 2 litre
    f. How many 5 litre or larger
    g. How many bottles are soft drink bottles in total?
    h. How many bottles are Maas bottles in total?
2. Paper cardboard - weight (kg)
    a. How many ‘product’ boxes?
    b. How many maize-meal paper bags?
    c. What type of products? Write words.
3. Tetrapak (liquid packaging board) - weight (kg)
    a. How many Tetrapak items?
    b. What type of Tetrapak products? Write words.
4. Food - weight (kg)
    a. What type of food? Write words.
5. Plastic bags - weight (kg)
    a. How many grocery bags?
    b. How many bread bags?
    c. How many plastic maize-meal bags?
6. Disposable diapers & sanitary towels - weight (kg)
    a. How many disposable diapers?
7. Glass - weight (kg)
    a. How many alcoholic glass bottles?
    b. How many non-alcoholic glass bottles?
8. Tins - weight (kg)
    a. How many steel cans?
    b. How many alcoholic aluminium cans?
    c. How many non-alcoholic aluminium cans?
9. Plastic packaging - weight (kg)

a. What type of plastic packaging? Write words.

10. Received receipts? (Yes/No)

Participants were requested to either bring their sorted waste to pre-determined locations once per week (Figure 15), or to ensure that the materials were available for weighing at their homes.

Figure 15: Weekly weighing of waste in Matshelapata
Source: Researchers

Waste was weighed by the data capturers by means of a hand scale (Figure 16) and these data were used to complete manually the spreadsheet (Figure 17).

Figure 16: Weekly weighing of household waste by hand scale
Source: Researchers

Figure 17: Manual completion of the waste characterisation spreadsheet
Source: researchers

After each weighing event, the handwritten data were captured electronically by a suitably qualified data capturer on Microsoft Excel.

As part of the last weighing event (either during week 4 or week 5), a final questionnaire was completed for each household (Figure 18).

Figure 18: Completion of final waste characterisation questionnaire
Source: Researchers

4.2.1 Results from the waste characterisation studies

The waste characterisation studies determined the average waste generation per capita per day within the various target suburbs as follows:

- Calvinia West: 0.16 kg/capita/day
- Bergmanshoogte: 0.17 kg/capita/day
- Poding-tse-Rolo: 0.18 kg/capita/day
- Matshelapata: 0.09 kg/capita/day
- Groenheuwel (Paarl): 0.14 kg/capita/day

Less waste is generated in Matshelapata on average per person per day (0.09 kg/capita/day) in comparison to the other target areas (ranging between 0.14 – 0.18 kg/capita/day). One possible reason could be the fact that the population is more rural, and thus has greater access to fresh produce (not pre-packed) from street vendors (Matshelapata is about 15 km from food-producing Magoebaskloof). The graph below (Figure 19) gives a breakdown of the quantity of the various waste fractions generated per target area.

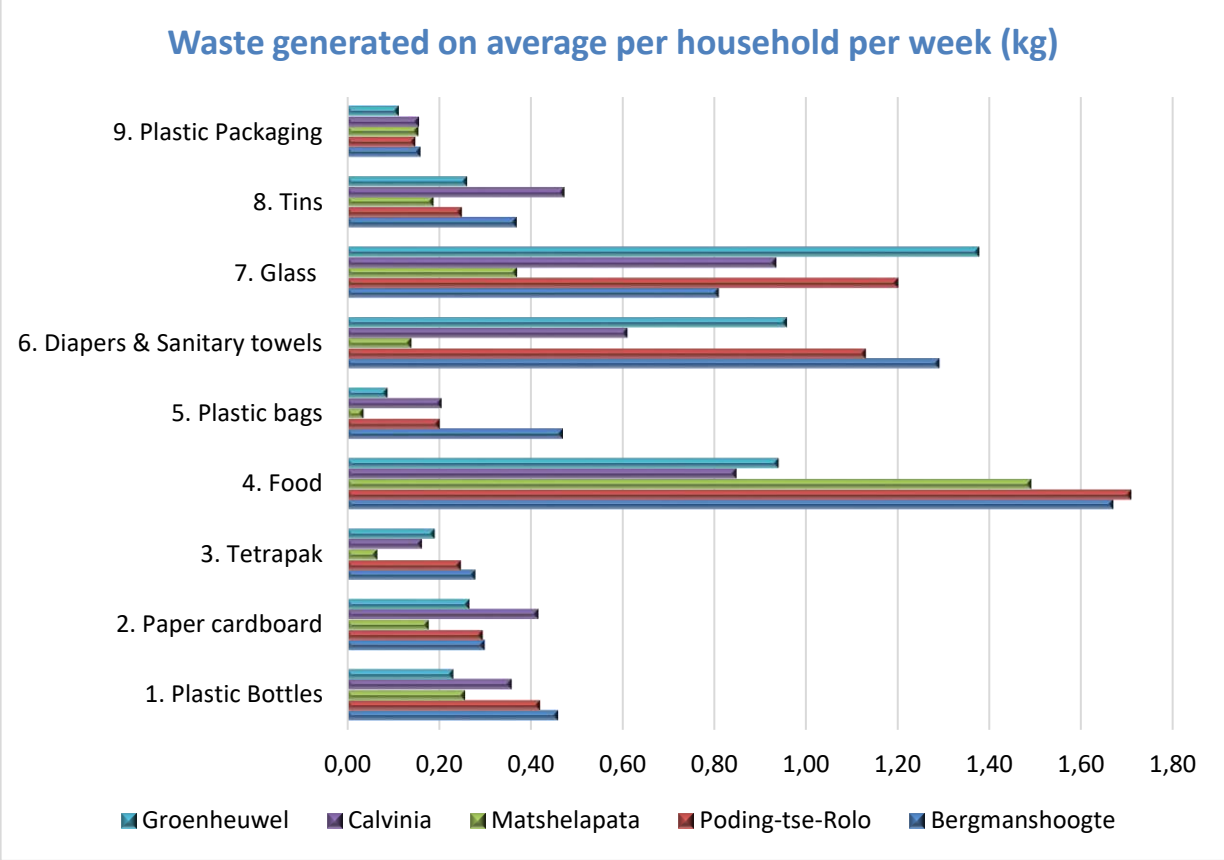

Figure 19: Waste generated on average per household per week (kg)
Source: Research data

In all target areas food waste was the main contributor to the waste stream, with an average generation of between 0.85 - 1.71 kg/household/week. This accounted for 20% - 52% of the waste composition in the target areas as per the pie charts below. Food waste was found to be minimised / managed in all target areas by utilising it as animal feed (e.g. dogs or pigs as was indicated in the household questionnaire). Mostly food waste was recorded as being inedible, or perceived to be inedible, or portions of food such as peels, skins and bones. A sizeable amount of starchy food waste was also recorded, such as leftover rice and mealie-meal porridge.

The following pie charts illustrate the various waste compositions of the target areas:

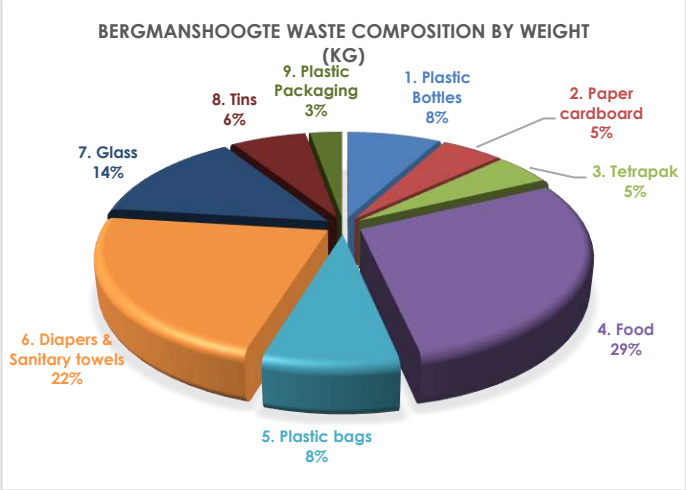

Figure 20: Bergmanshoogte waste composition in weight
Source: Research data

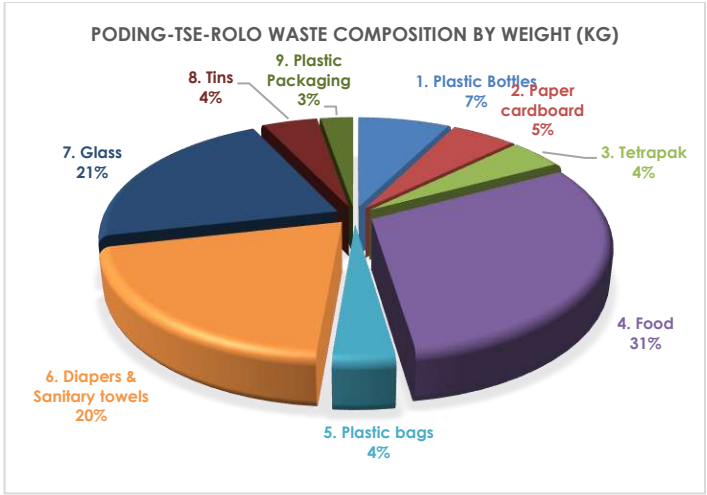

Figure 21: Poding-tse-Rolo waste composition per weight (kg)
Source: Research data

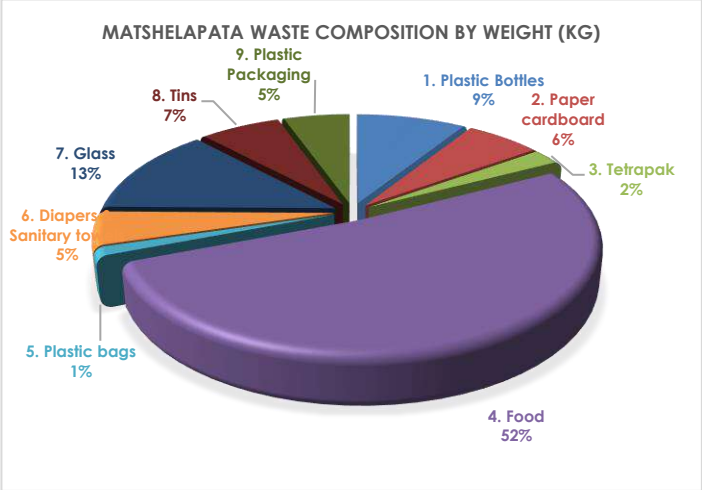

Figure 22: Matshelapata waste composition per weight (kg)
Source: Research data

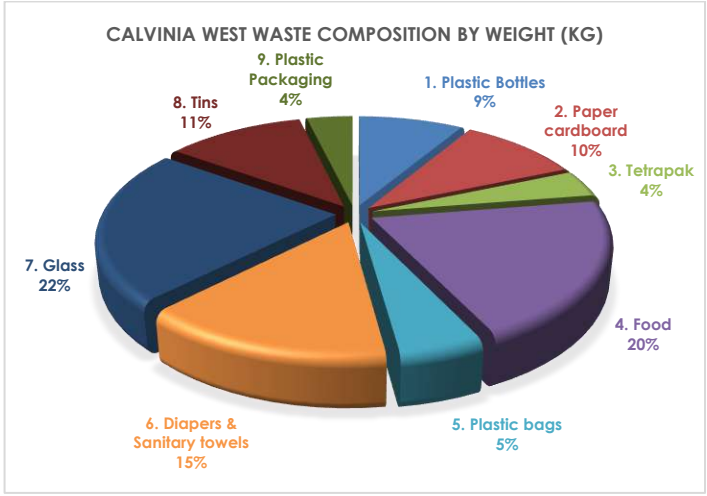

Figure 23: Calvinia-West waste composition by weight (kg)
Source: Research data

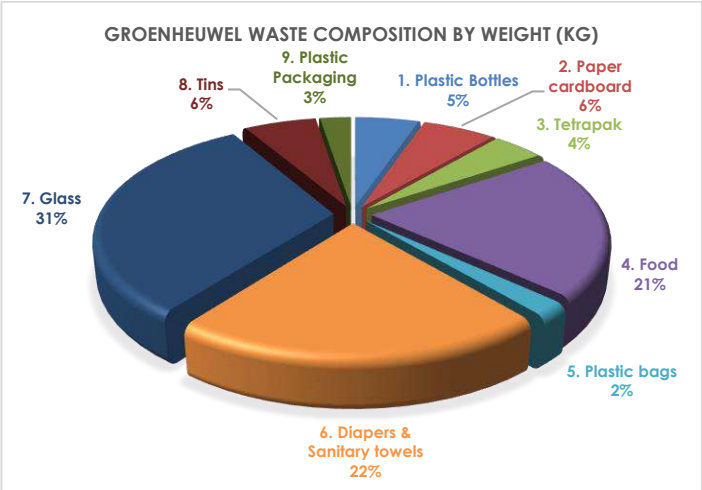

Figure 24: Groenheuwel (Paarl East) waste composition by weight (kg)
Source: Research data

The two dominant waste fractions were glass and diapers. The quantity of glass waste generated ranges between 0.37 [13%] (Matshelapata) – 1.38 [31%] (Groenheuwel) kg/ household per week. Glass items generated were divided into alcoholic glass items and non-alcoholic glass items. Alcoholic glass items included beer, cider, wine and spirits bottles. Non-alcoholic glass items included mostly food jars and bottles containing condiments and preserves. In all target areas, alcoholic glass items were present in larger quantities than non-alcoholic items, with the ratios as follows:

Bergmanshoogte:	1.43 alcoholic : 1 non-alcoholic
Poding-tse-Rolo:	2.19 alcoholic : 1 non-alcoholic
Matshelapata:	1.41 alcoholic : 1 non-alcoholic
Calvinia:	2.66 alcoholic : 1 non-alcoholic
Groenheuwel (Paarl):	1.67 alcoholic : 1 non-alcoholic

Households were requested to hold off on returning to shops or liquor stores any returnable glass items with deposits since the last weighing until they were weighed. Households mostly complied with this request in all target areas, but some indicated that they could not comply with the request because of cash flow constraints and therefore returned the bottles to the store to receive their deposit. The quantity of alcoholic glass noted in the waste characterisation studies is not deemed a reliable indicator of alcohol consumption in the study area as consumption of alcohol also takes place elsewhere such as at taverns or in open areas. In some target areas, such as Calvinia, alcohol is also packaged in plastic bottles (Figure 25), a waste item not specifically quantified during the waste characterisation study.

Figure 25: Wine packaged in plastic bottles in Calvinia
Source: Researchers

Table 13 below presents a summary of the generation within households of the various waste fractions that can be expected based on waste characterisation data.

Table 13: Waste statistics in target areas

Waste Item	Poding-tse-Rolo	Bergmanshoogte	Calvinia West	Matshelapata	Groenheuwel
Number of households*	849	112	1400	935	2292
Plastic bottles	468 298 items / annum	64 150 items / annum	592 807 items / annum	210 264 items / annum	1 428 848 items / annum
Plastic grocery bags	343 889 items / annum	48 542 items / annum	471 016 items / annum	27 597 items / annum	282 193 items / annum
Maize meal bags	78 680 items / annum	11 791 items/ annum	40 121 items/ annum	12 473 items/ annum	71 510 items/ annum
Bread bags	363 595 items / annum	54 488 items / annum	669 032 items / annum	66 039 items/ annum	622 523 items / annum
Alcohol	303 634 items / annum	30 995 items /annum	378 924 items / annum	62 648 items / annum	589 907 items / annum
Diapers	353 743 items / annum	50 441 items/ annum	448 945 items/ annum	243 100 items / annum	641 415 items/ annum
* Source: StatsSA, 2012					

Source: Research data

The study shows that households consume on average four (Matshelapata, Groenheuwel), seven (Calvinia West) and eight (Poding-tse-Rolo, Bergmanshoogte) 2-litre soft drinks per week. Poding-tse-Rolo, Bergmanshoogte and Calvinia West are the highest users of plastic grocery bags (8 per household per week) and Matshelapata residents generate less than one plastic grocery bag per week. Poding-tse-Rolo and Bergmanshoogte residents consume the most maize-meal (2 maize- meal packages of various sizes per week) with Calvinia West and Groenheuwel generating the least maize-meal packaging waste (0.6 per household per week) as this product is not a meal preference. Calvinia and Bergmanshoogte residents show the highest reliance on store-bought bread, with 9 bread bags generated per household per week in comparison to Matshelapata residents, who generate only one bread bag per household per week. Alcohol consumption is quite similar over all five target areas, where five alcohol-containing units are generated per household per week, with the exception of Poding-tse-Rolo where seven units are generated.

During Week 4 we also asked the participants to list the items bought in bulk (monthly) which did not appear in the weekly household waste.

Table 14: Items bought in bulk which do not appear in the weekly household waste

Calvinia	Philippolis	Matshelapata (Polokwane)	Paarl-East
Bread meal Potatoes Frozen chicken Sugar Coffee (Ricoffy 750 g)	Bread meal Mealie meal Sugar *Meat:(did not specify) **Vegetables	Tinned Fish Baked Beans Eggs Mealie meal Frozen chicken	Sugar Meat/chicken Rice Flour Milk (6-pack long-life)

*Meat is unspecified as they will obtain what is available from the abattoir in Philippolis or what is provided from the game reserves.

**Vegetables are bought once per month when travelling to Colesberg, e.g. potatoes/cabbage

Source: Research data

The difference between the diets of the Matshelapata participants and those of the Calvinia and Philippolis participants was interesting and determined by availability and diet preferences. In Calvinia and Philippolis the bread and maize-meal bags were re-used to store their waste, and thus these bags did not feature in the waste characterisation study. The use of tinned food in Matshelapata was also evident in the illegal dumping spots where we noted many tins having been dumped (see Figure 26).

Figure 26: Dumped tins - Note that they were mindfully dumped in a donga[5] to prevent erosion

Source: Researchers

Note:
It is important to note that during the study in Matshelapata, the resident researcher who was liaising with the community on behalf of the researchers realised the monetary value of the tins and started collecting the alu and steel tins to sell at the local BBC 10 km from Matshelapata for an income.

During the completion of the Week 1 questionnaire, households were required to indicate the number of diaper-wearing infants in the house, the number of adults making use of incontinence products, as well

[5] 'Donga' is referred to as a dry gully, formed by the eroding action of running water.

as the average number of diapers generated per day. The quantity of diapers recorded during the studies did not tally with the number expected based on the answers received from the questionnaires. Table 15: Diaper generation statistics below shows the expected data generation figures according to answers received from Week 1 questionnaires in comparison to data generated during the studies:

Table 15: Diaper generation statistics

Target area	Number of households generating diapers according to questionnaire answers	Number of households generating diapers according to study data	Number of diapers said to be used on average per hh per week	Number of diapers disposed on average per hh per week according to study data
Poding-tse-Rolo	14	Week 1: 19 Week 2: 26 Week 3: 29 Week 4: 34 Week 5: 25	29.4	Week 1: 16.6 Week 2: 17.1 Week 3: 16.4 Week 4: 13.1 Week 5: 15.4
Bergmanshoogte	8	Week 1: 13 Week 2: 15 Week 3: 19 Week 4: 18 Week 5: 11	15.8	Week 1: 20.6 Week 2: 19.8 Week 3: 16.0 Week 4: 13.1 Week 5: 19.9
Calvinia-West	11	Week 1: 26 Week 2: 26 Week 3: 26 Week 4: 12	32.5	Week 1: 26.2 Week 2: 8.8 Week 3: 7.7 Week 4: 11.4
Matshelapata	11	Week 1: 10 Week 2: 15 Week 3: 12 Week 4: 12	9.1	Week 1: 5.4 Week 2: 4.9 Week 3: 7.7 Week 4: 8.1
Groenheuwel	11	Week 1: 14 Week 2: 17 Week 3: 16 Week 4: 15	6.2	Week 1: 5.3 Week 2: 4.9 Week 3: 4.5 Week 4: 6.8

Source: Research data

Two major variations are seen in the diaper waste usage and disposal practices. Firstly, the number of households who claimed that they had diaper-wearing infants at home and the number of households who actually generated this waste type did not tally – the latter was higher in all areas (up to 243% in Poding-tse-Rolo, where 34 households generated diaper waste and only 14 indicated that they had diaper-wearing adults or infants at home). Secondly, the actual number of diapers generated per household per week did not tally with the expected number of diapers to be generated – it was lower in all areas except for Weeks 1, 2, 3 and 5 in Bergmanshoogte, where the expected number was exceeded.

Fieldworkers were told by the participants that they were not prepared to keep the diapers in or around the house for an entire week in order for them to be weighed because of the perceived or real health risks. This is clearly shown in Table 13: Waste statistics in target areas where in Calvinia West, for example,

26 diapers per diaper-using household were generated per week in Week 1, dropping to 14 diapers per diaper-using household per week for the rest of the study. On the other hand, some inconsistencies in the data were found, such as two houses in Calvinia generating 133 and 98 diapers each during Week 1, dropping to zero each in Week 2, increasing again to 8 and 5 each in Week 3 and ending with the generation of 8 and 28 in Week 4.

The usage and disposal practices regarding diaper waste therefore needs to be more carefully studied. Later in the report, the illegal dumping of disposable diapers is discussed and will shed some light on the management of diapers.

4.2.2 Feedback from fieldworkers (lessons learnt for future use of the methodology)

1. Some fieldworkers explained that the waste categories were not necessarily relevant to their target area. An example mentioned is that the spreadsheet requests information regarding maize-meal and sour milk, but in some areas little of these products is consumed. In Calvinia, for example, we were told that it would have been more appropriate to list cake flour and normal milk.

2. Plastic bags were used as temporary storage for waste materials. Fieldworkers noted that see-through bags worked much better in comparison to opaque bags. As they were able to see through the bags, it required less physical handling of the waste materials. This was an important consideration, especially during the pandemic.

3. The lists circulated to participants were printed in black and white to reduce printing costs. Fieldworkers noted that the document would have been more useful if it had been printed in colour as some participants, especially the elderly, struggled to see the pictures clearly in black and white.

4. Fieldworkers were asked to visit each household at least once per week before weighing to check whether the households understood the sorting process and to answer any questions. Feedback showed that the fieldworkers progressively realised the value of these check-ins as the time they had to spend weighing each household's waste was directly influenced by how well the waste had been sorted.

5. Fieldworkers were trained to explain to potential participants that the project was being conducted for research purposes only and that no further employment opportunities or other benefits were to be expected after the project had ended. Although this was communicated, fieldworkers reported that some participants still had expectations of receiving some form of added value to their lives after the project.

4.2.3 Summary of the findings

1. The waste characterisation study provides insight into what kind of waste is generated in the households in terms of quantities and weight. Diapers and food waste are the waste fractions

generated most. Diapers were clearly also the most difficult waste fraction to deal with. Diapers are dumped even if residents have waste services, as they do not keep them in their bag or bins (in the house) for a week – if there is no storage space, such as a closed bin, outside where the diapers can be kept. Specific diaper waste storage and collection systems are needed; otherwise the diapers will be dumped.

2. Opportunities with regard to food waste are possible at a household level, such as composting; greater awareness and education are needed.
3. The researchers were impressed by how well the participants were able to sort and store their waste into the ten categories of waste. Their sense of achievement was observable.
4. The differences in the waste generation also show clear differences in the culture and context (accessibility) patterns of diets. All townships were different regarding the waste generated.
5. Returnable bottles were seldom found as they were a source of regular income for the household or the children. This was also the case with returnable PET bottles.

4.3 Results: Illegal dumping mapping

The investigation and mapping of illegal dumpsites was undertaken in each of the townships. The aim of the exercise was twofold: firstly, to identify and plot the geographical coordinates of all existing illegal dumpsites in the study area in relation to where residents live; and, secondly, to determine the main waste fractions contained in each illegal dumpsite.

Figure 27: Illegal dumping in progress
Source: Alex Kimani

During the visits to the townships a number of incidents in which residents, mainly children, were dumping waste, using either a wheelie-bin and/or a wheelbarrow, were observed. It is assumed that the children are sent by adults to do the dumping (see Figure 27).

In the next section each townships' illegal dumping hotspots are mapped and the content analysed will be discussed.

4.3.1 Illegal dumping Philippolis

Figure 28 provides the visual presentation of the illegal dumping hotspots in Poding-tse-Rolo in Philippolis.

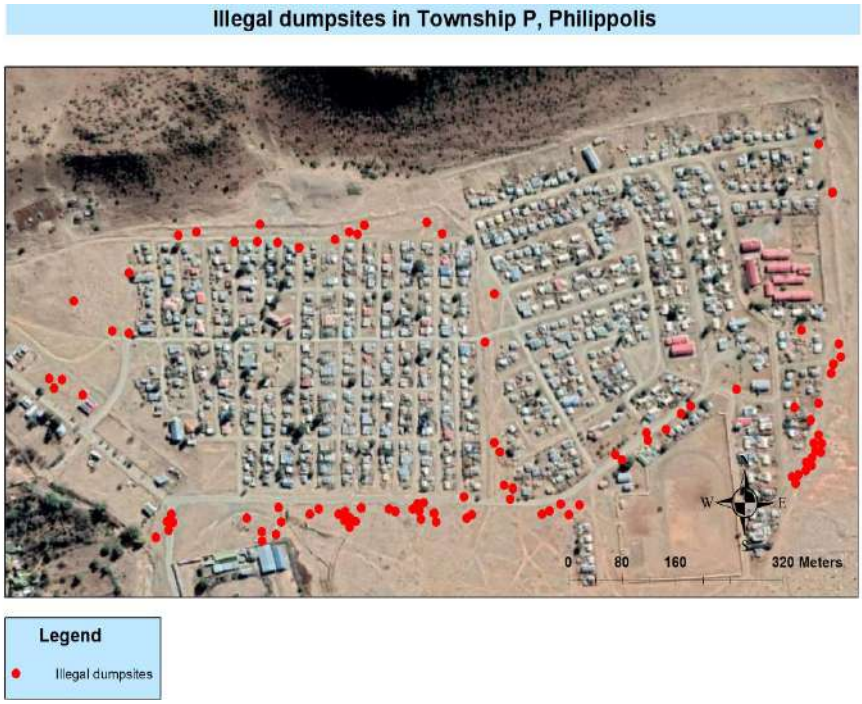

Figure 28: Illegal dumpsites in Poding-tse-Rolo, Philippolis
Source: Alex Kimani

In Poding-tse-Rolo a total of 98 illegal dumping spots were identified. Here residents opted to dump their waste in multiple tiny heaps, next to one another, rather than making one communal heap. It was observed that the volume of each heap was roughly equivalent to one wheelbarrow load. When walking through the veld we observed what we thought were small, naturally occurring heaps of earth, but they were actually older waste heaps that had become overgrown with grass. A reason why residents opted to dump their waste in smaller heaps could be to minimise the time required for the waste to be covered by vegetation and hence limiting the visual impact.

Figure 29: Illegal dumping in Bergmanshoogte, Philippolis
Source: Alex Kimani

In Bergmanshoogte we observed and mapped a total of 39 illegal dumping spots that were larger and more 'communal' or 'shared', where multiple waste loads from different households had been dumped in one spot.

Figure 30: Garden waste in Poding-tse-Rolo
Source: Researchers

Figure 31: Bulky waste in Poding-tse-Rolo
Source: Researchers

Figure 32: Animal skull in Bergmanshoogte
Source: Researchers

Figure 33: Animal skin in Bergmanshoogte
Source: Researchers

An interesting waste stream seen in Bergmanshoogte was that of abattoir waste. Many animal skins or hides and large quantities of animal bones, carcasses and horns were seen dumped in the veld, which included those of small livestock, such as sheep and goats, but also larger game, such as eland, giraffe and buffalo (Figures 32 and 33). Residents explained that certain community members have standing arrangements with local game farmers who own or manage hunting farms in the area. The farmers sell the off-cuts (heads, entrails and feet) to the residents who then either use them for sustenance or clean and sell them to other members of the community. This was confirmed by one of the professional hunters who are responsible annually for the culling of game to supply butcheries. The game that could not be sold to the butcheries is not taken to the abattoir in Philippolis but is directly delivered to the contact person in Bergmanshoogte. The skins are therefore found in the veld.

In both Poding-tse-Rolo and Bergmanshoogte, with the exception of one or two illegal dumpsites, all dumpsites were located on the outskirts of the built-up environment. In the cases where heaps were located between homes, this was because these had initially been heaps of grass, stones and wind-blown litter, gathered by EPWP workers and ready for removal, but then were never removed. These heaps subsequently morphed into illegal dumpsites (as per the 'broken windows' theory by Wilson and Kelling, 1982).

Figure 34: Dumped clothing and shoes in Poding-tse-Rolo, Philippolis
Source: Researchers

Figure 35: Dumped organic waste - cut grass in Bergmanshoogte
Source:Researchers

The four waste fractions not found during the household waste characterisation studies, but found illegally dumped, were garden waste (Figure 30 and Figure 35), textiles and shoes (Figure 34), bulky waste (Figure 31) and animal hide and bones (Figures 32 and 33). These are clearly waste fractions which the

community struggles to dispose of as they cannot fit into a bag (and they do not have bins). Transport is also not affordable to be able to take the waste to the landfill sites. Despite the multiple dumpsites, the premises of the residents were very clean. This was the case in all the townships visited.

4.3.2 Illegal dumping Calvinia

Different from Philippolis is the dumping in Calvinia-West among the houses and not on the outskirts of the township (Figure 36).

Figure 36: Calvinia illegal dumpsites
Source: Alexander Kimani

Despite the fact that Calvinia has regular waste removal, 63 individual dumpsites among the houses were mapped during the data collection, with 17 identifiable waste fractions. The waste fractions identified included: garden waste, glass, plastic, construction and demolition waste, sanitary waste (diapers), metals, cardboard, mixed domestic waste, pet excrement, wood, white paper, renovation-related waste, bulky waste, newspapers, chips packets, animal bones, and automotive waste (including waste tyres). Garden waste fractions illegally dumped consisted mostly of cut grass, plant trimmings and branches. Glass waste consisted mostly of empty liquor bottles and was concentrated especially around or opposite taverns. Illegal dumping of glass bottles with a return deposit was not observed. Plastic waste consisted mainly of plastic grocery bags and plastic soft-drink bottles, but was not found to be greatly influenced by location. In many cases plastic items seemed to be littered on top of already existing illegal dumps or, if windblown, to be 'caught' by existing dumps. Construction waste consisted predominantly of demolition waste (plasterboards, drywall and insulation). Dumped renovation-related waste included old carpets and cupboards. Metals included burnt copper wiring and shards of metal pieces, presumably from household appliances and machines. Wood waste included old and used timber that had been used to construct informal and backyard dwellings. Cardboard waste seemed to originate mainly from shops, as they were predominantly boxes used for delivery of goods in bulk and may have originated from the informal shops

(called ‘smokkelhuise’ or ‘smuggling houses’) in the township. White paper waste comprised mainly old schoolbooks. Bulky waste included white goods such as a broken washing machine, a mattress and also a broken wheelbarrow. Automotive waste included waste tyres as well as various car parts. Dumpsites also included pet excrement (dog faeces). This appeared to be an established practice, as if the entire community had decided to allocate certain spots to dumping dog faeces. Many households had dogs as pets and there were also many dogs freely roaming the streets. Dumped animal bones included jaw and skull bones of sheep or goats, with some of the bones notably burnt. In some instances, sheep, goat and dog carcasses were observed. The burying of household pets is not a common practice. Large quantities of discarded clothes, shoes and other textiles, such as curtains and bed linen, were also dumped. Some dumpsites were found on the outskirts of the town, but most were found in front of houses and even in open spaces where signposts specifically prohibit dumping (see Figure 37).

Figure 37: Open spaces with dumped waste with signage prohibiting any dumping
Source: Researchers

Figure 38: Waste dumped in open space with signage prohibiting any dumping in Calvinia
Source: Researchers

Figure 39: Child playing on dumped mattress
Source: Researchers

Figure 40: Dumped clothing and shoes in Calvinia
Source: Researchers

Figure 41: Dumped garden or yard waste in Calvinia
Source: Researchers

Figure 42: Dumped garden or yard waste in Calvinia
Source: Researchers

Figure 43: Waste (consisting of clothes) dumped in the river bed behind the township in Calvinia,
Source: Researchers

Questions posed to the community with regard to why there were so many clothes and shoes dumped despite the fact that they can fit into a bag or bin did not really elicit explanations from the community except for *"This is what people do"* (i.e. it's habitual) *or "I do not know"* –an aspect that needs further explrotaion.

Again, as in Philippolis, the participants explained that they did not have transport to take bulky or extra waste to the landfill site, despite the fact that the landfill site was within one kilometre from the township.

4.3.3 Illegal dumping in Matshelapata

Matshelapata is the area with no waste services rendered by the local municipality. Similar to Philippolis, the illegal dumpsites were found around the township and not among the houses (Figure 44).

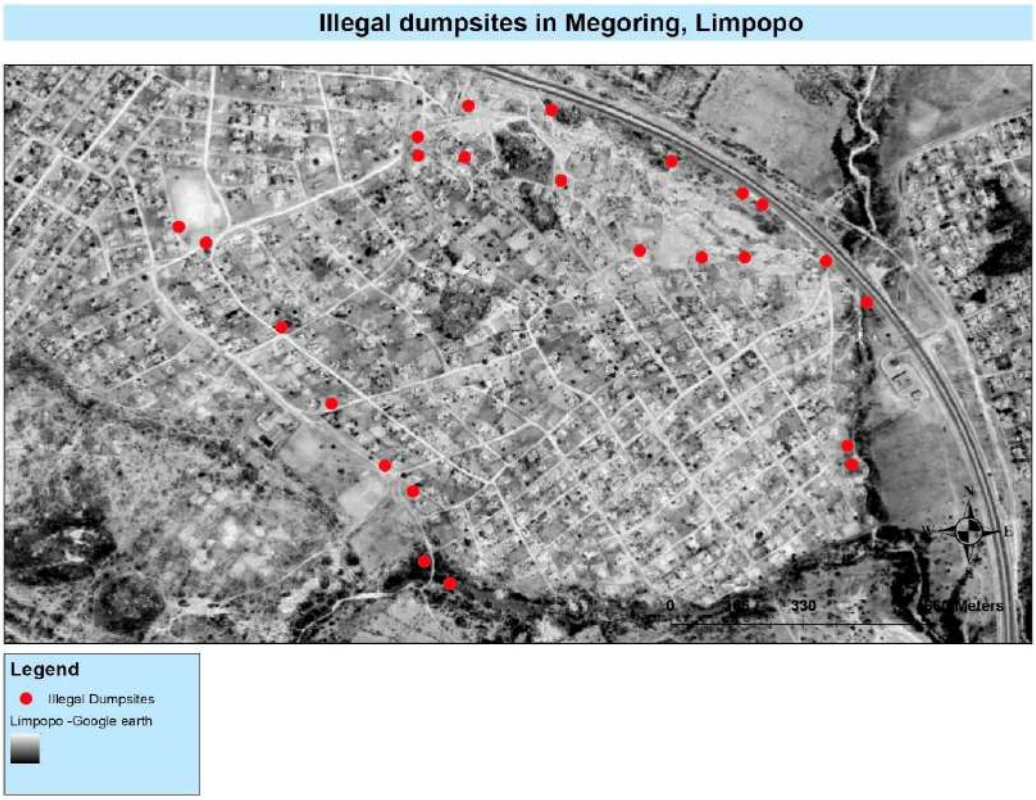

Figure 44: Mapping illegal dumping in Matshelapata/Megoring
Source: Charlotte Nell

As shown, the premises around the houses are swept clean (Figure 45).

Figure 45: Clean premises around the houses in Matshelapata
Source: Researchers

Large quantities of dumped diaper waste were found around Matshelapata township (Figure 46 and Figure 47). Approximately 80% of all dumpsites mapped contained diaper waste. Partially burnt and dumped diapers were also observed and it was evident that the inherent characteristics and high cellulose content of diapers did not make them suitable for burning; they just turned into a jelly-like consistency similar to tree gum.

Figure 46: Dumped diapers in Matshelapata
Source: Researchers

Figure 47: Dumped diapers in the riverbed in Matshelapata
Source: Researchers

On further questioning, the residents admitted that diapers were the most difficult waste fraction for the community to deal with as there are no waste collection services rendered to the community. They used to bury or burn their waste, but diapers can neither be buried nor burned because of their composition. The result is that they are dumped in the dongas around the township, which is also the catchment area for one of the dams providing water to four other villages. The presence of the vast number of diapers in the veld explains the absence of diapers in the household waste characterisation study.

The dumping of glass waste was also a matter of concern in Matshelapata. Figure 48 shows glass waste disposed of outside a tavern, but many similar heaps were seen in and around the area.

Figure 48: Dumped glass waste (non-returnable beer bottles)
Source: Researchers

The community shared that there is no BBC willing to buy the glass and, accordingly, non-returnable glass bottles have no value and are dumped. The researchers did later find a BBC in Tzaneen (+/-50 km away) which buys glass; however, the community was not aware of this. When interviewing the BBC owner, he drew our attention to the fact that he is also limited with regard to buying and selling glass because of the quota system that was implemented by the recyclers at the time. The buying of glass is not really profitable because of its low value, but he buys it more in support of the informal waste collectors in and around Tzaneen.

4.3.4 Illegal dumping in Mbekweni

In Paarl, illegal dumpsites in the suburb of Mbekweni were mapped by Kimani (2021).

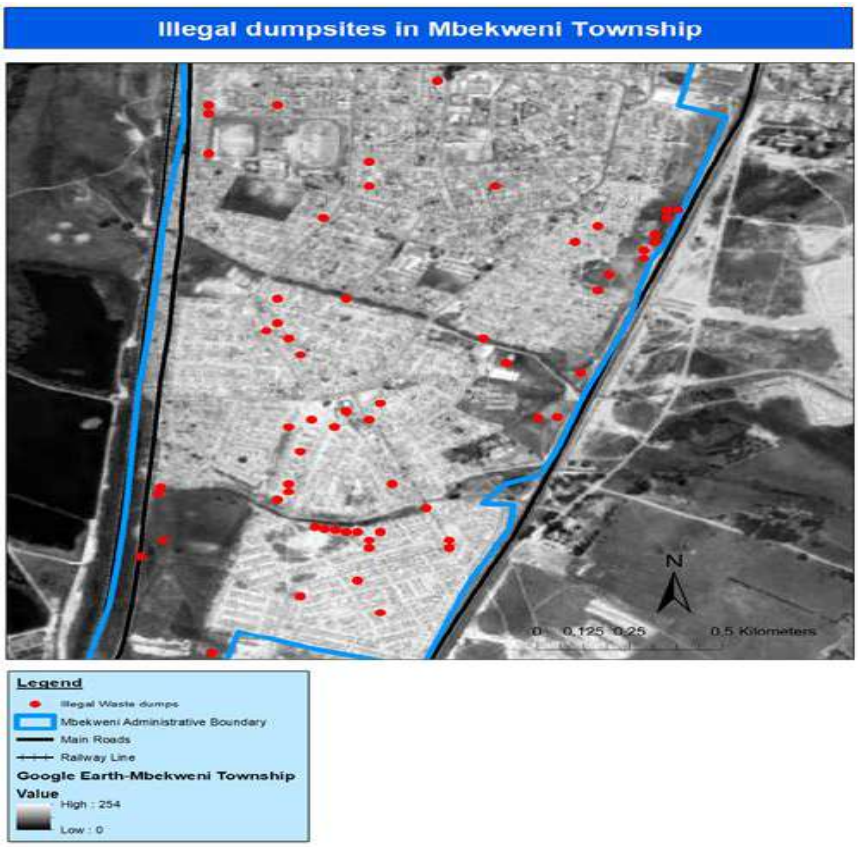

Figure 49: Illegal dumpsites in Mbekweni (Paarl)
Source: Alexander Kimani

Figure 49 shows the 62 illegal dumpsites in the Mbekweni township. There is a clustering of illegal dumpsites in certain parts of Mbekweni, representing an issue of illegal dumping in these particular areas over others.

During the mapping process, a total of four formal drop-off facilities were identified throughout Mbekweni. Figure 50 provides a visual representation of the spatiality of waste facilities in Mbekweni, and how they relate to illegal dumpsites. Three of the mini drop-off facilities on the eastern extent of Mbekweni were built structures. A skip was located on the western extent of Mbekweni opposite the railway line. This skip was being used for household waste disposal by the residents of the OR Tambo informal settlement. It was interesting to see that the three mini drop-off facilities were all situated in the same relative location. Municipal officials indicated that the mini drop-off facilities were built in that specific area of Mbekweni to combat a serious issue of illegal dumping. From the spatial distribution of illegal dumpsites in relation to the drop-off facilities and the waste skip, there is an obvious need for additional waste facilities in Mbekweni. As such, linking this to the interviews with some residents, an issue brought up by several residents was that the newly built mini drop-off facilities were situated too far from their homes and served and benefited only people residing in the immediate surroundings of the drop facilities. Several illegal dumpsites were situated in the proximity of the drop-off facilities, especially puzzling considering that the drop-off facilities were specifically built in that location to curb illegal dumping. Thus it appears that the drop-off facilities have not been as effective as they should be in mitigating illegal dumping.

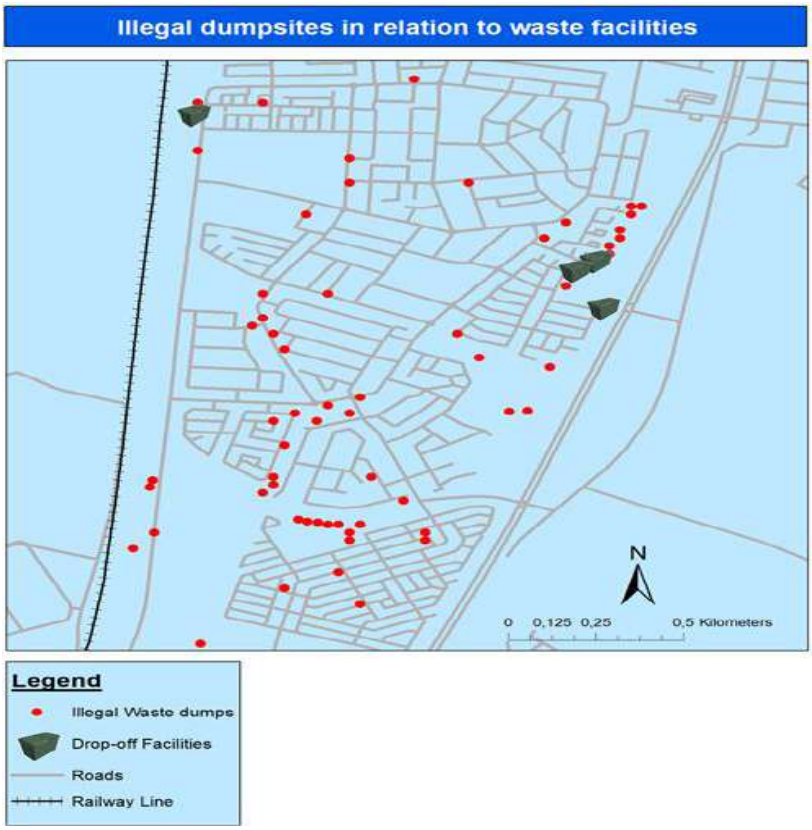

Figure 50: Illegal dumpsites in relation to formal drop-off points
Source: Alexander Kimani

These dumps had eventually expanded into large waste dumps. Figure 51 below provides an example of the situation found at the drop-off facilities. The amount of waste being dumped outside the facilities is visible, despite clear signs at the drop-off facilities noting where to drop off the waste. This dumping defeats the purpose of the mini drop-off facilities, degrades the surrounding areas and distorts the public perception of what drop-off facilities are used for.

Figure 51: Mini drop-off built in Mbekweni to curb illegal dumping
Source: Researchers

Figure 52: Vandalised mini drop-off
Source: Researchers

Sadly, this mini drop-off was vandalised (Figure 52) and burnt. The study on the evaluation of the mini drop-offs by Schenck et al. (2021) found that, if the mini drop-offs are not managed daily, they just become additional illegal dumpsites and are regarded as another unjust and unequal attempt at service delivery.

In Mbekweni, the illegal dumpsites consist mostly of construction and demolition (C&D) waste rubble, and household waste. The least common types were glass and metal. It is quite peculiar that rubble was amongst the most common waste types. This problem could be attributed to the constantly changing nature of infrastructure (such as structures in the informal township and backyarders) in Mbekweni from which large amounts of rubble are being generated. Interviews with the residents informed the researchers that residents who were either building extensions onto their houses or building new homes or shifting from shacks to formal housing, would often illegally dump the rubble as there were no other disposal alternatives. Residents pointed out that in order to dispose rubble, they were required to transport it to the landfill site in Wellington and pay an additional gate fee. They can neither afford transport and nor a landfill fee. The household waste was collected in black bags or plastic bags. This was an indication that household waste was either not being collected and then dumped, or excess household waste was thrown out. Some residents admitted to placing excess waste in a plastic bag and dumping it. Specifically, disposable nappies were being dumped (Kimani 2021). Of great concern in Mbekweni was that many of the dumpsites were on the riverbanks and in the rivers, as can be seen in Figures 53 and 54.

Figure 53: Dumped rubble in Mbekweni
Source: Alex Kimani

Figure 54: Dumped household waste in the river
Source: Alex Kimani

4.3.5 Illegal dumping in Fisantekraal

Article
The following article provides a detailed explanation of the dynamics of illegal dumping in Fisantekraal: Niyobuhungiro, R. & Schenck, C. J. (2021). The dynamics of indiscriminate/illegal dumping of waste in Fisantekraal, Cape Town, South Africa. *Journal of Environmental Management*. 293:112954. https://doi.org/10.1016/j.jenvman.2021.112954

The Fisantekraal study was approached slightly differently as we visited and mapped the dumpsites over a period of nine months to determine the dynamics around the illegal dumpsites. What also makes the study in Fisantekraal unique is the fact that a very active NGO in the community organised monthly clean-up campaigns with the community to clean the environment and raise awareness on illegal dumping.

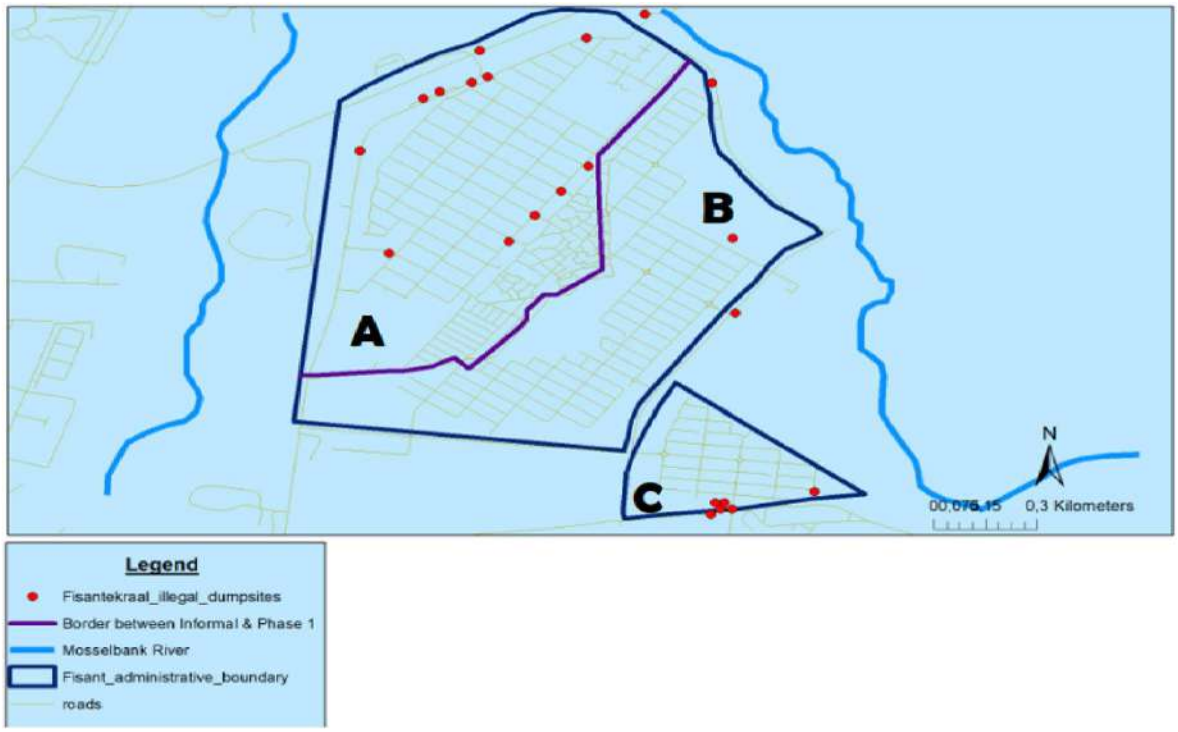

Figure 55: Mapping illegal dumping in Fisantekraal
Source: Rissa Niyobuhungiro

From the map it can be seen that Area A, which is the biggest area but which also contains the most informal housing, has the most illegal dumpsites. Of the 23 identified illegal dumpsites, 13 were in Area A. From the first round of data collection (July 31, 2019) to the last (January 10, 2020), no dumpsite disappeared despite the efforts of the community and the contractor of the CoCT to clean up the dumpsites and to raise awareness each month. Rather, new dumpsites were formed and a few of the existing ones were extended. Three main characteristics of the dumpsites were:

1. After every clean-up the dumpsites reappear;
2. New and extended dumpsites appear; and
3. Dumpsites are in visible open spaces.

In Area A, mostly garden waste, rubble, and asbestos were prevalent on the dumpsites. Participating community members acknowledged that they do not have the transport to take the waste to designated drop-off points 10 km away, taking into consideration that the residents are predominantly poor and therefore not able to afford transport to the facilities. In Area B, two dumpsites contained unknown household waste (unknown because it was packed in blue plastic bags provided by the municipality). It was confirmed that the waste originates from the households and that the residents do not have sufficient space to keep it in their houses or on their premises. In Area C, where plastics and glass were prevalent,

the waste also seemed to originate from households, as there are no spaza shops (informal shops in townships) or shebeens (drinking places or bars). The increase in the number of dumpsites and quantities of waste could be the result of the increase in population turnover. Based on the type of waste found in Fisantekraal, its location and prevalence, it can be concluded that households and spaza shops are the main dumpers. This study shows that clean-ups and awareness did not make any difference to the change in the numbers and sizes of the indiscriminate dumpsites in Fisantekraal, given that there are no other options for households to manage their waste .

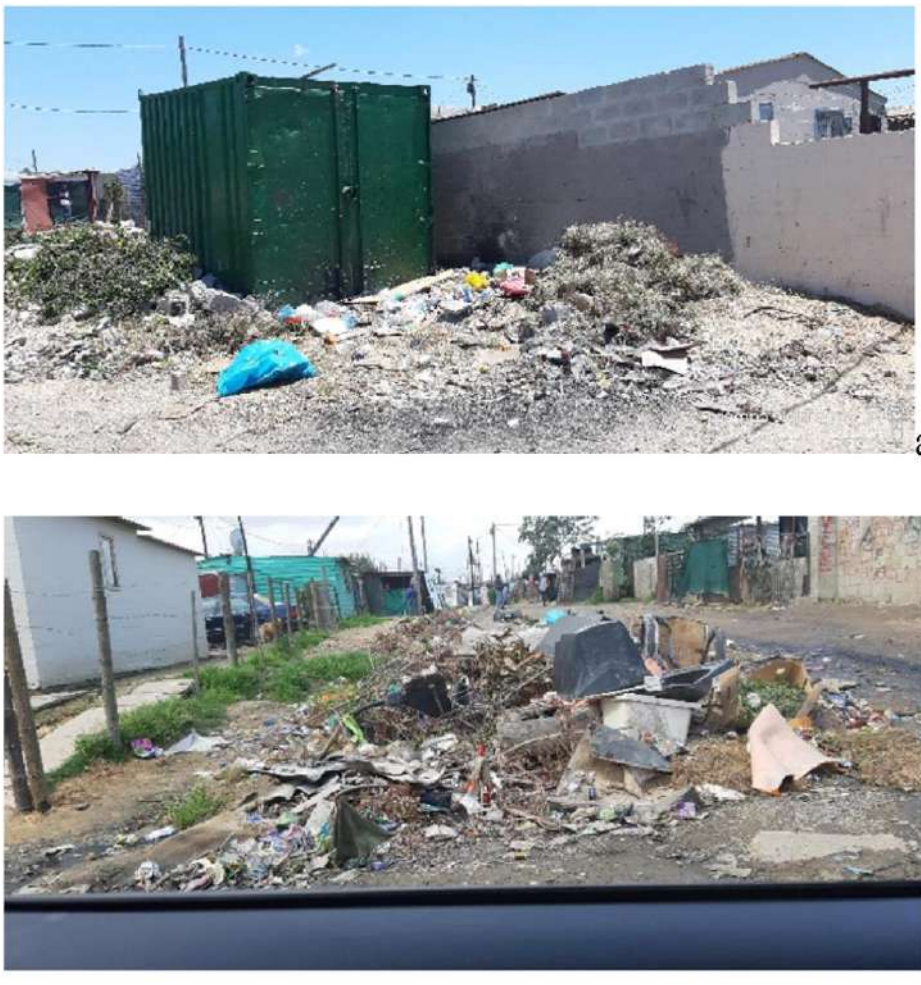

Figure 56: Dumped illegal garden waste in Fisantekraal
Source: Rissa Niyobuhungiro

4.3.6 Summary to mapping and analysing illegal dumping

1. One perspective on illegal dumping is that even though the dumping of waste is labelled illegal, such dumping is not purposefully criminally motivated but is a way of managing waste.
2. In the areas where regular waste removal services are delivered, such as DM and Calvinia, illegal dumping is still prevalent, and the weekly removal might not be sufficient and appropriate for the needs of the community. The waste management options for low-income residents without access to transport are limited. Thus, the one action that is within their power to take in order to

manage their own waste is to dump it illegally. Rubble, diapers and garden waste seem to be particularly problematic. More innovative options and support should be investigated.

3. The reason for the dumping of textiles should be further explored as it is a waste fraction that can go into a bin.
4. Solutions, such as mini drop-offs or skips, become locations for unchecked dumping if not well managed and regularly cleaned.
5. Vandalising resources for waste management might be criminal, drug-related or an expression of anger and frustration at the authorities, or an attempt to keep the waste under control. This aspect needs further exploration.
6. It is evident that waste management services for lower-income areas need a re-thinking/design and a different approach which should be planned in collaboration **with** the community. The provision of bins and bags and even the availability of mini drop-offs do not solve the problem if more appropriate access to waste management options is not considered.
7. Close working relationships between the municipalities, civil society, the private and the informal sectors, as well as the general communities, should be fostered.
8. Judging by the clean yards and houses, it is clear that people do 'manage' their waste, but education and awareness regarding how to manage it with the opportunities available are needed. Fit-for-purpose facilities and opportunities for lower income areas should be explored and co-developed.

In the next section we provide the results derived from the interviews with respect to the residents' perceptions regarding the reasons for littering and illegal dumping in their areas.

4.4 Results: Perceptions about the reasons for the occurrence of illegal dumping and littering

This section will discuss the results based on the 322 interviews that were held with households in the four municipalities, as well as with the residents of Fisantekraal. In DM we interviewed households from both Paarl East and Mbekweni. The results from the two townships are presented separately as the characteristics of the townships are very different.

The results of the interviews exploring the perceptions of street vendors, taxi drivers and commuters and train commuters are also added to this discussion as the major themes (reasons for dumping and littering) were similar. The more complete discussion of the results of the taxi drivers and commuters, street vendors and train commuters can be found in the two articles listed below.

Articles:

Schenck, C. J., Grobler, L., Blaauw, D. & Viljoen, K. (2021). Commuters' perceptions of littering on trains in South Africa: A case of environmental Social Work. *Southern African Journal for Social Work and Social Development,* 33(3):1-19. https://doi.org/10.25159/2415-5829/9951

Schenck, C., Grobler, L., Viljoen, L., Blaauw, D. & Letsolao, J. (2021).
Double whammy wicked: Street vendors and littering in Mankweng township and Paarl, South Africa-Towards people centred urban governance. *Urban Forum*.
https://doi.org/10.1007/s12132-021-09455-3

4.4.1 Summary of the reasons for littering and illegal dumping

Table 16 provides an overview of the themes identified from the interviews with the different groups of participants.

Table 16: Thematic analysis of reasons for littering

	1	2	3	4	5	6	7	8	9
Themes	**Matshelapata**	**Mbekweni**	**Paarl East**	**Philippolis (Bergmans Hoogte, Poding-tse-Rolo)**	**Calvinia**	**Street vendors in Paarl and Mankweng**	**Taxi drivers and commuters**	**Train commuter**	**Fisantekraal**
Theme 1: Value systems and personality traits	x	x	x	x	x	x	x	x	
Theme 2: No respect and lack of care for self, others and the environment	x	x		x	x		x	x	x
Theme 3: Experiences of a non-caring and non-engaged government	x	x	x	x	x		x	x	x
Theme 4: Lack of (appropriate) infrastructure and resources and no effective service delivery	x	x	x	x	x	x	x	x	x
Theme 5: Littering and dumping lead to job creation	x	x		x	x	x	x	x	x
Theme 6: Lack of education and awareness	x	x	x	x	x		x	x	x
Theme 7: Xenophobic/cultural differences ("It's them.")		x	x				**x**		**x**
Theme 8: Non-collaborative community				x	x	x	x		
Theme 9: Systemic/structural poverty and inequalities	x	x	x	x	x				x
Theme 10: Sanitation, litter and dumping						x	x	x	

Source: Research data

The answers provided by the participants with regard to Theme 1 (personality traits), Theme 2 (not caring attitude), Theme 4 (ineffective and insufficient infrastructure), Theme 6 (Lack of education and awareness) and Theme 10 (sanitation, litter and dumping) raise issues that occur in the literature globally (Niyobuhungiro & Schenck, 2020; Grobler et al., 2022). Theme 3 (non-caring government), Theme 5 (littering and dumping create jobs), Theme 7 (xenophobia), Theme 8 (no collaboration within communities) and Theme 9 (poverty and inequality) can be regarded as results uniquely related to South Africa. The reasons as expressed by the participants relate directly to the broader South African context and fall within the characteristics/indicators of socially disorganised communities as summarised in the theoretical section of this report. Theme 10, making the link between sanitation, littering and dumping, is an international phenomenon which could be seen as representing infrastructure challenges, but, as it was highlighted in particular by those affected most by and dependent on public ablution facilities (street vendors and taxi drivers and commuters), it is dealt with here as an additional theme.

1. Theme 1: Value systems and personality traits

Oguntayo et al. (2020) define the personality of a person as individual differences and an enduring characteristic pattern of thinking, feeling and reasoning that leads to behaviour. Carl Rogers, an American psychologist, views behaviour as intentional and determined by a person's emotions, thoughts, experiences, perceptions and locus of control (Grobler et al., 2013).

In all towns, residents, train commuters, taxi drivers and commuters, as well as street vendors, viewed littering and dumping as linked to the person (or personality traits) and the value system of the person. The question asked was: "Why do people litter?", not "Why do **you** litter?" It was therefore easy for the participants to ascribe the personality traits to another person. Attributes identified included laziness: "… *because they are too lazy to use rubbish bins";* ignorance: "…*ignorance and not wanting to take responsibility for their waste";* naivety: "*never mindedness"* and habit: "… *like at home that's how they act in other places too"*. "*Upbringing"* and "*It's a lifestyle"* were added*. "You eat chips and cooldrink not near a bin so you just throw in the streets. If you are not clean and tidy in your own house you will not be clean outside….."*

2. Theme 2: No respect and lack of care for self, others and the environment

Robert Chambers (2004) refers to the sense of agency, ownership and responsibility which a person adopts for his/her own and others' well-being. Littering and dumping have implications for the well-being of self and community. The lack of respect and caring for self, others and the environment were major concepts that emerged in six out of the eight groups being interviewed: "*They have no self-respect for themselves and other people"; "They do not care about the environment"; "They do not care about the community."*

Participants further ascribe this behaviour to "… *no discipline. No respect. I have a rubbish bin at home so I keep everything in my pocket until I reach home. We have to keep our town clean. People have no discipline at their homes. (We) need to care."*

In addition to not being raised to care, the lack of caring for self, others and the environment also seems to be a result of a non-caring community or context: "*People litter simply because they see other people don't care; they just throw their litter in the streets."* This view links with the 'broken window' theory: "*People litter sometimes because the area is already dirty and they just add on to the dirty place"; "People*

don't respect [town's name]*"; "… because they find the place already littered so they think that there is no need to bother looking for bins."*

In his study on illegal dumping in Mbekweni, Kimani (2021) also found that residents highlighted a lack of care. Participants in Kimani's study thought that people in Mbekweni just did not care about their fellow neighbours, the environment and the cleanliness of Mbekweni and that there was little community pride among the residents.
The taxi drivers confirmed that commuters do not care about the condition inside their taxis as they will leave the taxis in a mess, not willing to take their own litter with them when they get out. The train commuters described how they discard their litter on the floor of the train or out of the window - then *"it is gone"* - not caring whether it is leaving the train messy or littering the environment.

3. Theme 3: Experiences of a non-caring and non-engaged government

The non-caring theme continues in the participants' reported experiences of a government (local and national) that lacks showing care for and does not engage with residents: "*Honestly, I couldn't care less. The South African government doesn't take their citizens seriously*"; "*Some people already decided that there is nothing good left for them because the municipality is corrupt and so they will keep on littering.*"
This attitude was explained as deliberate: "*They* [residents] *are doing it deliberately" (Hulle doen it 'aspris')"; "At times they are spiteful – even if they stand next to the bin they will still throw it on the ground."*

"They [the municipality] *don't have facilities. They don't care about the community";* "*All the bins are broken*" [referring to their being vandalised]; *"People litter because municipality don't collect waste*"; "*The* [name of the municipality] *must come and do their own work.*"

Train commuters added: *"The government does not care"; "The government does not do its work to keep it clean"; "It is unpleasant to use the trains"; "The government does not do its work to clean the station."*
Comments were then also made referring to those EPWP[6] workers and government officials who "… *are lazy and do not do their work"* which also results in perceptions of a non-caring government.

Green (2018) describes the elements of care, fairness and competence as the three keys to government legitimacy, which seem to be absent in the experiences of the participants. Hawkins (2006:6) is of the opinion that waste behaviour, such as littering, can often be seen as 'victimised anger and frustration', and Nkocha and Okeoma (2009:155) argue that littering/dumping "is a brutal expression of loss of hope among urban dwellers".

4. Theme 4: Lack of (appropriate) infrastructure and resources and no effective services

In line with 'global' reasons for littering and dumping are ineffective, inappropriate and insufficient infrastructure and waste management services (Nyobuhungiro & Schenck, 2020; Grobler & Schenck, 2022). This theme was highlighted in all groups of participants interviewed. Reflecting on the comments, it is not just a matter of a lack of infrastructure and services but also inappropriate and insufficient infrastructure and services:

[6] EPWP-Extended Public Work Programme

Street vendors: *"There are no dustbins here at the shops"; "I think it's the lack of proper facilities because street vendors even opt to use card-boxes as bins"; "Lack of dustbins around*. *When there are no dustbins near, a person can litter because they want to get rid of the waste they're carrying especially when they have just finished eating."*
Cleaning staff shortages were also identified as part of the problem: *"Because there aren't enough cleaners or facilities for waste disposal available".* Moreover, some of the EPWP workers were described as lazy and not doing their work.
In the bankrupt Philippolis, participants commented: *"They* [the municipality] *can't afford to buy facilities"; "Not enough resources for waste. They don't have facilities at all."* Because there are not bins in Philippolis, residents claimed that stray animals caused litter in the streets. The late or non-collection of refuse by the municipality meant that dogs and pigs tore at the bags first: *"The municipality don't collect waste. People don't have enough facilities and they use old maize-meal bags and you find out dogs and pigs tear the bags*." "*Dogs and pigs vandalise the bins if they are not collected."*

Although DM provides wheelie bins and bags to their residents, Paarl East residents highlighted the lack of facilities, bins and bags for backyard and shack dwellers. It was pointed out that the bins of those who do receive them (those living in RDP houses) often *"get stolen". "I have four backyarders on my yard, so one bin is not enough for the households on my yard. So, the best option is to go and dump my waste."*

What became clear in the interviews, and is supported by Kimani (2021) and Schenck et al. (2021), is the need for resources, such as black bags, municipal bins, and well serviced additional infrastructures, such as drop-off facilities and communal skips, as people in lower socio-economic areas do not have the means to buy these facilities or transport their waste except by putting it on a wheelbarrow to be dumped. In addition, it seems that one black bag and bin is not sufficient for some houses because of overcrowding and the presence of backyarders. Once-a-week removal might also not be sufficient. If there is excess household waste, this would result in residents dumping their waste because they lack storage space, in particular in informal settlements. In Mbekweni, residents expressed the wish that additional drop-off facilities be built on '*their*' (informal housing) side of Mbekweni, so that they could dispose of their excess household waste properly. However, these facilities are often vandalised (see the case study on mini drop-offs in DM by Schenck et al., 2021) or, if not properly managed, become an 'illegal dumpsite'.

In all the towns, residents made us aware that, although they might have regular household waste collections, certain waste streams are still problematic to manage for households in lower income areas and therefore waste management services are experienced as ineffective and inappropriate.

Some residents reported not knowing what to do with unique types of waste, such as dead dogs, used disposable diapers (area specifically referring to brand names such as *Kimbies, Huggies and Pampers*), bulky waste (e.g. couches, mattresses) and construction and demolition (C&D) waste: *"The problem here is that the people don't know where they can throw the Kimbies* [disposable diapers] *and* [dead dogs] *… Kimbies do not belong in a bin"; "You can't put the rubble in the bin yabon, so people they throw it here".* A resident in Fisantekraal put it bluntly: *"If we clean our yards then what do we do with the waste?"*

It was pointed out that the refuse collection trucks or workers will not accept items that do not fit into the bin or bag. Not having the means to transport it to the landfill, residents would simply then dump

those types of waste in an open space or an existing illegal dumpsite. One of the participants stated that *"[p]eople have to learn and understand one thing, where can we put the dirty things, how we can clean our place."* Both access to services and facilities, as well as education with regard to managing these waste fractions, were then highlighted. The residents of Matshelapata, who do not have any waste removal services, explained that if certain waste fractions, such as diapers, cannot be burnt or buried, they will be dumped as they do not know what else to do with them. The train commuters, street vendors, taxi drivers and commuters emphasised that the lack of waste receptacles or their inconspicuous placement, was seen as one of the major factors of littering.

Hansmann and Steimer (2017), however, are of the opinion that infrastructure is often used by people to divert responsibility for their behaviour. They argue that most participants excuse their waste disposal behaviour by referring to the dysfunctional infrastructure. These authors describe the tendency to deny personal responsibility as a process of justification and a means of self-protection against self-blame and blame from others (Hansmann & Steimer, 2017).

The maintenance and replacement of infrastructure as a result of vandalism was highlighted by both residents and municipalities. One of the taxi drivers in Paarl described how bins are vandalised at the taxi rank: "*The bins have to be replaced two times per year. They are vandalised. They are burned. Now they have put up concrete bins, but they are smashed. If it is made from metal, it is stolen. If it is from plastic, it will be burned.*" This behaviour was confirmed by taxi drivers in Mankweng who indicated that 'nyaope' boys are seen as the vandalisers and thieves of the bins (nyaope is a dangerous street drug).

Figure 57: Concrete bin to prevent bins being vandalised in Paarl
Source: Researchers

The report by Schenck et al. (2021) provides a detailed description of the vandalism that occurred to destroy the mini drop-off facility in Mbekweni. It was burnt and vandalised and hardly anything was left of the mini drop-off. The social disorganisation theory, as summarised by Niyobuhungiro (2020), is of relevance here. The vandalism of infrastructure requires further exploration.

5. Theme 5: Littering and dumping lead to job creation

A theme that does not appear in the literature but emerged in seven of the eight groups of participants is that littering and dumping can be regarded as leading to job creation. In this study - and studies conducted in other developing countries - some participants reasoned that littering creates jobs and that they have to sustain job creation opportunities (Tanyanyiwa, 2015). Given the South African unemployment rate of 34.9% in the third quarter of 2021 (Stats SA, 2021), this reasoning is not surprising. Some of the train commuters expressed the opinion that they should litter as *"[s]omeone will clean – it is a job for someone".*

In Calvinia-West, Mbekweni and Matshelapata residents confirmed that littering and dumping are creating jobs: *"People litter because they think it is a way for them to create jobs for others."* The comment by a resident from Matshelapata was interesting: "*We are black and a black child will always want to give another person a job."* A participant in Matshelapata expressed the following view: *"I think that democratic rights has been well explained to people because people use this* [to] *act literally and they end up thinking that when they litter, many jobs would be opened because the municipality would see* [the] *need to hire more waste pickers."*

A slightly different perspective was presented in Philippolis (where the municipality is not functioning), namely that *"the municipality should hire us to do the work as they* [Kopanong Municipality] *are not doing their work"* and "*The municipality should give our children the work as they don't do their work."* Although the waste management system in Philippolis was not functioning, the municipality employs a number of EPWP workers to clean the streets. Similarly, in Calvinia there were very active EPWP and community development workers programmes to keep the streets of Calvinia clean. Participants from these two communities believed that residents abdicated their responsibility for maintaining a clean environment because someone will eventually clean up: "*The problem lies with the people that likes to live like this and expect the municipality to clean"*; "*Deliberate, because they know there are people who clean after them and that they* [the cleaners] *get paid.*"
Kimani (2021) confirms that residents in Mbekweni felt that the municipality could employ more people within Mbekweni to clean the community. *"The municipality can employ more people, because …. I'm willing to be part."* Mbekweni residents, according to Kimani (2021), saw the problem of illegal dumping as a potential opportunity for the municipality to employ more people. It was even acknowledged by residents that people in Mbekweni dumped their waste as an act of displeasure at being jobless, as well as at the municipality's failure to employ the residents. People are desperate for jobs and some of the residents felt that the only plausible action that could be taken to keep the community clean would be to pay people to clean their communities. There was an apparent linkage made between illegal dumping and waste management issues and unemployment or lack of jobs available. The following quotes corroborate people's grievances concerning illegal dumping. *"We need work for the municipality, we must be employed. When the municipality starts to employ us, we can start to do the work." "They must employ people to clean every time so it always stays clean. That is one of the reasons people are doing this* (dumping waste) … *They are looking for jobs from the municipality."*

It is important to rethink waste management services in the South African context and the (unintended) consequences of programmes, such as the EPWP programme and how it is managed and implemented.

6. Theme 6: Lack of education and awareness

With the exception of the street vendors, all groups perceived the lack of education and awareness as a reason for littering and dumping. The view is that people are not aware of the consequences of littering or not educated and raised not to litter: *"Some people are negligent and others lack education and awareness about a clean environment".* Some of the train commuters were of the opinion that people have a *"lack of knowledge about how to clean"*. Another participant elaborated that *"[p]eople think the littering will not affect their lives. They do not think it will cause damage*. *They are not educated enough. They do not know the repercussions of their behaviour."*

In particular, concerns were raised about the youth and children not being disciplined and taught by their parents: "[It is] *children that are not taught to be respectful to throw litter in bins"; "The parents do not teach their children not to litter"*; "*No discipline. Must learn at home"; "You as parent have to teach the child. Neatness and cleanliness come from the parent."* Schools are also regarded as being responsible for teaching children about caring for the environment and keeping it clean.

One of the major education and awareness aspects being raised was the need for information on how to deal with waste - in particular, difficult waste fractions, such as diapers, textiles, bulky waste and C&D. This will be further elaborated on in the recommendations made by the participants.

7. Theme 7: Xenophobia – "It's them"

This theme builds on Hansmann and Steimer's (2016) argument that people tend to find a scapegoat in other people and infrastructure. Interestingly enough, Paarl East, Mbekweni and the taxi drivers and commuters in DM and Fisantekraal were the areas and groups in which blame for littering and dumping was attributed to "*those from the rural areas* [of the Eastern Cape and/or foreigners]"; "(those) *people are lazy and don't want to be clean."* Comments were made that *"cultures differ*" when it comes to dealing with waste. In the heterogenous Fisantekraal the blame was also shifted to those from the other areas (areas B and C) who do not want to dump in their own area, but dump in area A (informal dwellings) – hence the majority of the illegal dumping spots there. This was not the case among the other five groupings, who live in more homogenous areas with a lesser threat of "inkommers" or migrants from rural areas and neighbouring countries.

8. Theme 8: Non-collaborative communities

Lack of community collaboration and cohesion was perceived as a reason for littering in Philippolis and Calvinia and was a view also shared by the taxi drivers in DM and Mankweng: *"They litter because they don't encourage each other not to. They don't understand how important it is to keep the streets clean* [*together*]*."* It was stated numerous times by residents in Philippolis that there is a need for working together, having meetings and *"taking hands"* to be able to keep the town clean. The dislocated and non-collaborative relationships currently experienced in the communities are seen as the reason for the dirty towns: "*We simply do not work together."* Participants also expressed the need to collaborate with the municipalities and the leaders. The latter should have meetings with residents and all others involved and co-develop answers. Currently decisions are made in a top-down manner. "*We should all work together. One person will not make a difference.*" It is assumed that the non-collaborative relationship prohibits the communities from standing together and claiming accountability from those in power- an aspect for further exploration.

9. Theme 9: Systemic/structural poverty and inequalities

Participants held the view that littering and dumping are part of the broader systemic issues in the communities and country, such as overcrowding, crime, vandalism, unemployment and general unhappiness with service delivery: *"… because so many people are living together on one stand and there are not enough bins"; "Our people love to vandalise. They do get the needed facilities but then it is stolen"; "Some people steal the dustbins"; "People are unemployed"; "The dustbins are stolen and burnt"; "Governmental problems, unemployment problems"; "… because there are no jobs."*

Kimani (2021) further notes that residents complained about not having sanitation facilities, such as functioning toilets and clean tap water, and felt that they had more pressing issues, such as clean water and ablution facilities, than to worry about dealing with waste. In some cases, these two issues have corroborated each other in a way that one form of community displeasure leads to the persistence of another problem, i.e. illegal dumping. The following comment also confirms some of the complaints made by the residents: *"We are living in a dirty place here … dirty water, 1 toilet for all of us."*

During the waste characterisation study we requested the participants to rank their infrastructural needs in terms of housing, water, waste, sewerage and roads (electricity was erroneously left out).

Table 17 provides an overview of the preferential needs.

Table 17: Priority of needs of the residents in the townships

	Paarl East N=39	**%**	**Philippolis N= 73**	**%**	**Calvinia N=48**	**%**	**Matshelapata N=44**	**%**
Priority 1	Houses 14	35,9	Houses 25	34,2	Housing 24	50	Water 23	52,2
Priority 2	Waste 9	23,1	Water 14	19,2	Waste 9	18,8	Housing- 8	18,1
Priority 3	Water 6	15,4	Roads 15	20,5	Roads 5	10,4	Waste 7	15,9
Priority 4	Sewerage 6	15,4	Sewerage 12	16,4	Water 5	10,4	Roads 3	6,9
Priority 5	Roads 4	10,2	Waste 7	9,7	Sewerage 5	10,4	Sewerage 3	6,9
Total	**39**	**100**	**73**	**100**	**48**	**100**	**44**	**100**

Source: Research data

In three of the four areas housing was highlighted as their major priority, while Matshelapata's residents highlighted water - which was not unexpected as they were the only area with no access to running water. Water is delivered by truck on a weekly basis despite the fact that piped water is available and connected to the area, but not delivered because of the drought and dilapidated infrastructure. For Philippolis, despite their insufficient, ineffective and at times total lack of waste management, waste is the least of their infrastructural problems as they have only two hours' access to water per day – and, in some areas, no access at all to running water. Similarly, Matshelapata lacks waste management services, but the residents have a greater need for running water and houses. In Calvinia and Paarl East, where water, sewerage and roads are provided, waste moved up the list as their second priority.

10. Theme 10: Sanitation, dumping and littering

The street vendors, taxi drivers and commuters, as well as the train commuters in particular, are all dependent on public ablution/sanitation facilities and, if these are not sufficient and cared for, this can give people the cue to litter and dump. These participants made the direct link between littering, dumping and sanitation: "*There is only one (public) toilet and it is blocked all the time*"; "*Toilets are a problem.* [People] *use any place. Drains are leaking*"; and "*Must also have proper toilet facilities. If not there, the people do their 'business' against the walls which gives a stench. It makes it unbearable to work in*."

4.4.2 Summary

Reflecting on the interviews with all the different groups and residents in the townships, the findings regarding the participants' perceptions pertaining to littering and dumping confirmed what was found in the waste characterisation study, the mapping of illegal dumpsites and the completion of the questionnaires. Not ignoring the fact that there are people who are just lazy and careless, the results emphasise the deep levels of poverty and inequalities, and the need for appropriate and engaged service delivery, education and awareness of what is needed in low-income and informal areas to be able to manage waste - in particular certain waste fractions. The need for a caring, non-corrupt and engaged government was expressed, as well as the urgency to view waste management as an income opportunity within communities. It clearly requires a more people-centred form of waste management (service delivery) system as will be seen in the next section in which the participants made recommendations towards a cleaner environment.

4.5 Results: Suggested recommendations by the participants toward a cleaner environment

Suggestions were further elicited on how people see the way forward towards cleaner towns and cities, and preventing littering and illegal dumping. The following thematic suggestions are summarised.

4.5.1 Suggestions

1. Suggestion 1: The provision of services, sufficient facilities and waste infrastructure

First and foremost residents requested good, equal, dignified service delivery, and regular refuse removal *"must come on time*", *"do more effort with rubbish rounds"* and provide bags and bins for those areas that do not receive them. Although Mbekweni, Paarl East and Fisantekraal households receive bins and bags, backyard dwellers have to do without these amenities; therefore they requested that they be given the required receptacles. Comments included: *"Collect waste on time"; "I think if backyard dwellers and informal settlements got their own reusable bins …"; "Collect the waste weekly"; "Provide bins and bags"; "Provide skips".* The provision of receptacles is important, but if skips, bins and mini-drop offs are not cleaned and emptied regularly, then it creates anger and frustration (Schenck et al., 2021) and they will become sources of illegal dumping and/or be vandalised and even destroyed. In Fisantekraal, containers were provided for the "yard waste" but were locked when the official was not present in the evening and over weekends with the results that residents dumped next to the container.

In all areas there were special requests for receptacles or solutions for *"yard waste*", as well as waste fractions which these communities struggle to manage, such as dead animals (dogs), bulky waste, yard (organic) waste and rubble which cannot fit into a bin. *"They should give us skips to throw our waste in; no facilities to dispose of; we need the municipal truck to come and collect waste because we don't have anywhere to put them."*

In summary: the participants expected that the municipality should actively fulfil its mandate of providing effective and equal service delivery (Haywood et al., 2021)**.** Solutions, however, should collaboratively be found for the waste fractions difficult to manage, backyard dwellers and overpopulated areas where weekly (if any) waste removal is not sufficient.

2. Suggestion 2: Collaboration *with* and *within* the communities

In all groups interviewed there were requests for collaboration and engagement between the municipality, other stakeholders and the community, as well as among the community members. Participants did not see area cleaning as only a municipal responsibility, but an opportunity for community engagement: *"We as the residents of this place can help to keep this town clean"; "Organise workshops to keep clean. Get people to talk about it"; "Appoint people to keep their own areas clean."* Residents from Calvinia suggested: "*Train a team to monitor the cleanliness of the town",* and "*Community groups must be made responsible for cleaning the town."* Some participants also highlighted the necessity for communities to work together: *"I would like the community to work together to clean the area".*

3. Suggestion 3: Create income in the community

The communities see the cleaning of the townships as a potential for income generation. This suggestion relates to high levels of unemployment in the towns coupled with insufficient waste management and the need for a cleaner environment. Innovative suggestions by residents included:
"Create jobs in waste removal. If the community clean the areas themselves, they will not litter where they have cleaned"; "Municipality can hire local people to clean the town each and every day"; "They can put people in positions to work in certain areas. To work and people will benefit from it"; develop *"projects for recycling of waste".* Instead of outsourcing cleaning services, divert funds for cleaning the community to the community. A participant specifically proposed that each recipient of the R350 COVID-19[7] social relief and distress grant should be given a bag and a broom to clean their environment!

4. Suggestion 4: Education and awareness

On the website of Hantam Municipality (Calvinia) the following African proverb is displayed: *"Lack of knowledge is darker than night."* Interestingly enough, the need for education and awareness regarding how to manage waste and waste fractions, cleanliness and the environment were emphasised by each and every group interviewed. It was suggested that education and awareness campaigns be presented consistently and with the support of municipal officials to help the community learn positive waste management practices. The following specific aspects or groups were highlighted.

- **The youth**: Residents stressed youth education concerning the importance of waste management, cleanliness, health and environmental awareness: "*Schools should introduce*

[7] During the COVID-19 pandemic the South African government provided a social relief and distress grant of R350 to the most vulnerable South African citizens.

environmental awareness"; "… if people teach our children correctly from a young age not to litter in the streets."

- **Waste, recycling and income generation:** Suggestions were made regarding education and awareness including *"how to dispose the waste in a good way"; "that waste is recycled and there is money in it"; "we want to know if we can recycle and make money out of waste".* In Paarl East enquiries were made about a different EPWP system in order for residents to be allocated their own areas to clean. Recommendations in Paarl also require the appointment of elderly women to oversee the cleaning of the areas (as people will listen to them).[8]
- **Waste and the environment**: More information was requested regarding specific waste fractions and their impact on the environment: *"I would like to know the impact of waste on the environment especially of disposable diapers"; "how to better dispose of diapers";* "*the municipality should carry out awareness programmes on sustainable waste management"*.
- **Waste logistics**: Information and knowledge about waste collection and dropping were required: "*where and how to transport waste; where to take waste"; "I think they must call a meeting and tell us exactly when will they come and fetch the waste"; "We do not really know when they will come and pick up the waste"; "No, they should inform us whenever they do not come on the day of waste collection"; "They should inform us whenever they will be having problems regarding the collection of our waste. We need to know if they won't be able to come and collect our waste".* These recommendations require improved communication with the residents to share information with regard to waste collection which affects them, such as notification when waste is not collected or when waste collections are late.
- **Waste storage and disposal:** Interesting were the suggestions that the residents be informed about where and how waste should be stored and disposed of. "*Die presiese aangewyse plek waar vullis kan gestoor word, as om dit in die velde te stoor" ("Show us the exact place where and how waste can be disposed of, rather than 'storing' (dumping) it in the veld"); "Meer informasie oor hoe en waar om vullis te stoor en wanneer dit opgelaai word" ("More information as to how to store waste and when it will be collected");* "*To know the impact and how to store the waste; how to manage the waste, and how to dispose or recycle the bottles and tins".*
- **Health:** Information is needed on waste and health issues, such as "*information about spreading germs"; "more info about community wellness"; "information on how illegal dumping is a health risk, where to put yard waste and dispose of it safely"; "more awareness on the hazards of plastic".*
- **General education and awareness**: *"Everything; I don't know anything about waste management, so any information would be useful"; "How are we supposed to live with waste because most people don't understand that our areas are supposed to be kept clean at all times"; "People need education, especially old people"; "People need education espec*ially *elderly people who have been burning waste for almost all their lives";* "*I would like to know what happens to the waste when it gets to the landfill sites".*
- ***Waste recycling: "****How recycling works"*; *"recycling, how to stop littering"; "We need to know more about waste recycling and separation"; "They should teach on how to separate waste in households and its benefits".*

[8] The "Auntie Dina" project was subsequently initiated in DM. "Auntie Dina's" have the responsibility to watch over the cleanliness of the towns

The expressed need for knowledge and skills regarding how to manage waste, including storing, disposing, and recycling practices, is positive. In principle, the communities are requesting improved engagement and communication.

4.5.2 Summary

The main themes from the suggestions made by the participants are illustrated in Figures 58 and 59.

Figure 58: Recommendations for a cleaner environment
Source: Research data

Figure 59: Recommendations for education and awareness
Source: Research data

The implicit message in the suggested recommendations refers to a request for engaged and collaborative service delivery that is appropriate for the local context of the community and can improve their quality of life.

4.6 Results: Communication with residents

During the interviews with the residents in the townships, communication between municipalities and residents was consistently emphasised. We explored the preferred channels of communication as residents urged municipalities to talk to them and *"create platforms to communicate*". Households were then requested to indicate their preferred mode of communication taking into account that the communities are lower-income communities and not all have access to electricity, wi-fi and the internet. The first question posed was to determine whether they use any social media apps (n = 453) as municipalities have web and Facebook pages, as well as WhatsApp groups, through which they communicate with the residents.

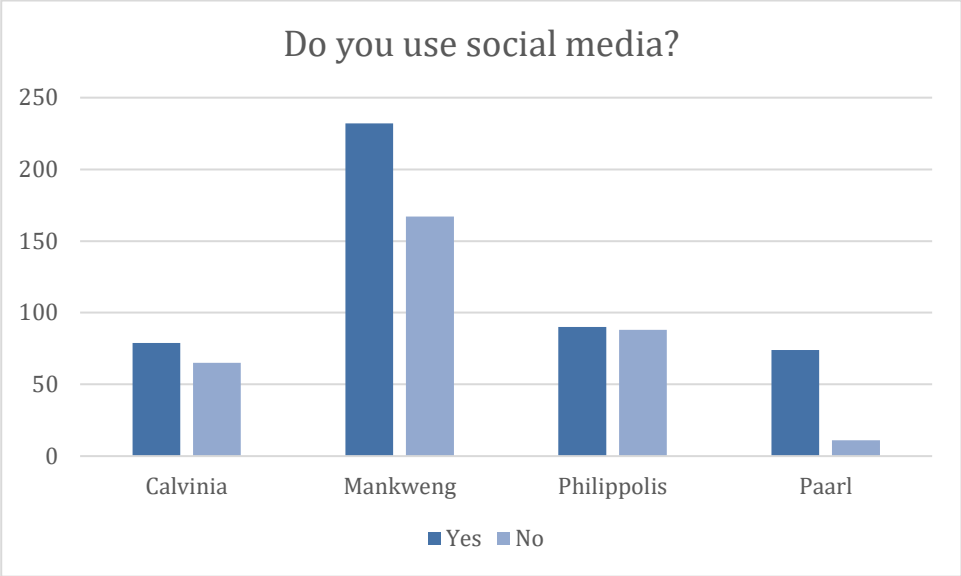

Figure 60: The use of social media
Source: Research data

Although the majority of residents acknowledged having access to social media, in the more remote areas, such as Calvinia, Philippolis and Mankweng, a considerable number of people still do not have access to social media due to the costs involved in buying data. When we explored their preferred mode of communication with the municipality, a variety of modes of communication were highlighted, as indicated in Table 18.

Table 18: Preferred channels of communication

	Philippolis N=181	**%**	**Calvinia N=181?**	**%**	**Mankweng (Polokwane) N=411**	**%**	**Mbekweni (Paarl) N=86**	**%**
Use of social media	Yes 90 No 87 No answer 4	49,7 48	Yes 79 No 65 No answer 37	43,6 35,9	Yes 232 No 165 No answer 14	56,4 40,1	Yes 74 No-12 No answer 0	86 14
Whatsapp	80	44,1	70	38,7	139	33,8	69	80
Facebook	50	27,6	57	31,4	189	46	62	72
Radio	Umhlobo Wenene Lesedi Thobela FM		Radio Kaboesna (all)		Variety		Variety	
Other	Loudspeakers community meetings Posters Radio		Radio Loudspeakers Community meetings		Community meetings Radio, newspaper schools, TV,SMS Pamphlets Door to door		Pamphlets; Local radio station; Community Forums.	

Source: Research data

Municipalities rightfully make use of social media, such as Facebook and WhatsApp, to communicate with their residents. The results in Table 18 show that a mix of media should be used to accommodate those who do not have access to social media mainly because of the unaffordability of data. In Calvinia and Philippolis fewer than half of the residents can afford the data needed for social media. Media, such as community meetings, radio, a pickup/bakkie with a loudspeaker/megaphone and pamphlets are preferred. Interesting was the popularity of the local radio station in Calvinia where most residents indicated that they listen to Radio Kaboesna. (While collecting the data, Radio Kaboesna was audible when interviewing outside the residences of the participants). Mbekweni (Paarl), which is the biggest urban area, has the biggest proportion of social media users. Of importance is the fact that all four communities emphasised engagements, such as community meetings/forums, as important to be able to have a platform to voice their concerns. With Mankweng still having traditional leaders and structures, the preferred mode of communication was community meetings.

4.6.1 Summary

The lesson learnt from these results is to determine with the community the most effective ways of communication between the community and the municipality - or agency responsible for the communication - in order for the community to experience inclusion.

4.7 Results: Buy-Back Centre studies - Calvinia and Philippolis

During the engagement with the communities, Philippolis and Calvinia community members expressed the need to recycle waste for the creation of a cleaner environment and as possible income-generating opportunities. Paarl and Mankweng have operational BBCs which provide income for informal waste collectors and individuals selling collected waste; however, these BBCs are not easily accessible to individuals and households without their own transport.

Some years ago, Philippolis attempted to establish a BBC, but it failed. The building - with a hand-baling machine provided by PETCO - was still in the hall during our first visit to the town in 2019. During 2020 the building burnt down, destroying the baler and what was left of the recyclables (Figure 61).

Figure 61: Recyclables, building and sponsored hand baler destroyed in the fire in Philippolis
Source: Researchers

One of the many reasons for the failed BBC was given as the distance to the closest BBC in Bloemfontein where the recyclables were sold. We did come across individuals in Philippolis who, although no operating as a BBC, were collecting aluminium tins on the landfill site and other scrap metal, and then transporting the collections to Bloemfontein once per month. At the time of the study aluminium tins had the highest value. One person, "Oom G" (Uncle G), actively collects tins on the landfill and at times pays children to assist with the collection of tins. He owns a pickup truck with which he could transport the tins to the BBC in Bloemfontein to make his few thousand rand (did not disclose the exact amount).

In Calvinia there are three (one formal and two informal) scrap metal dealers to whom people sell their collected scrap and aluminium tins/cans. The scrap is then transported to Cape Town. We also met "Tannie M" who for years now has been collecting glass (a waste fraction with one of the lowest monetary values) and aluminium tins (with one of the highest monetary values) on the landfills. She stores the glass and tins at her house and once every three months she will rent transport to sell the recyclables in Cape Town. According to "Tannie M" she pays R10,000-R15,000 for the transport, while she sells her collected glass and tins for R25,000. Her profit for the three months' work is thus R10,000-R15,000, which leaves her with an income of between R3,000 and R5,000 per month. In order to determine the feasibility of establishing a BBC in both Calvinia and Philippolis, we collaborated with Prof. Johan Joubert from the University of Pretoria's Industrial Engineering Department. Two of the final-year students completed feasibility studies on BBCs in Calvinia and Philippolis.

Figure 62 and Figure 63 are visual presentations of the results. The full report on Calvinia is available as Addendum D.

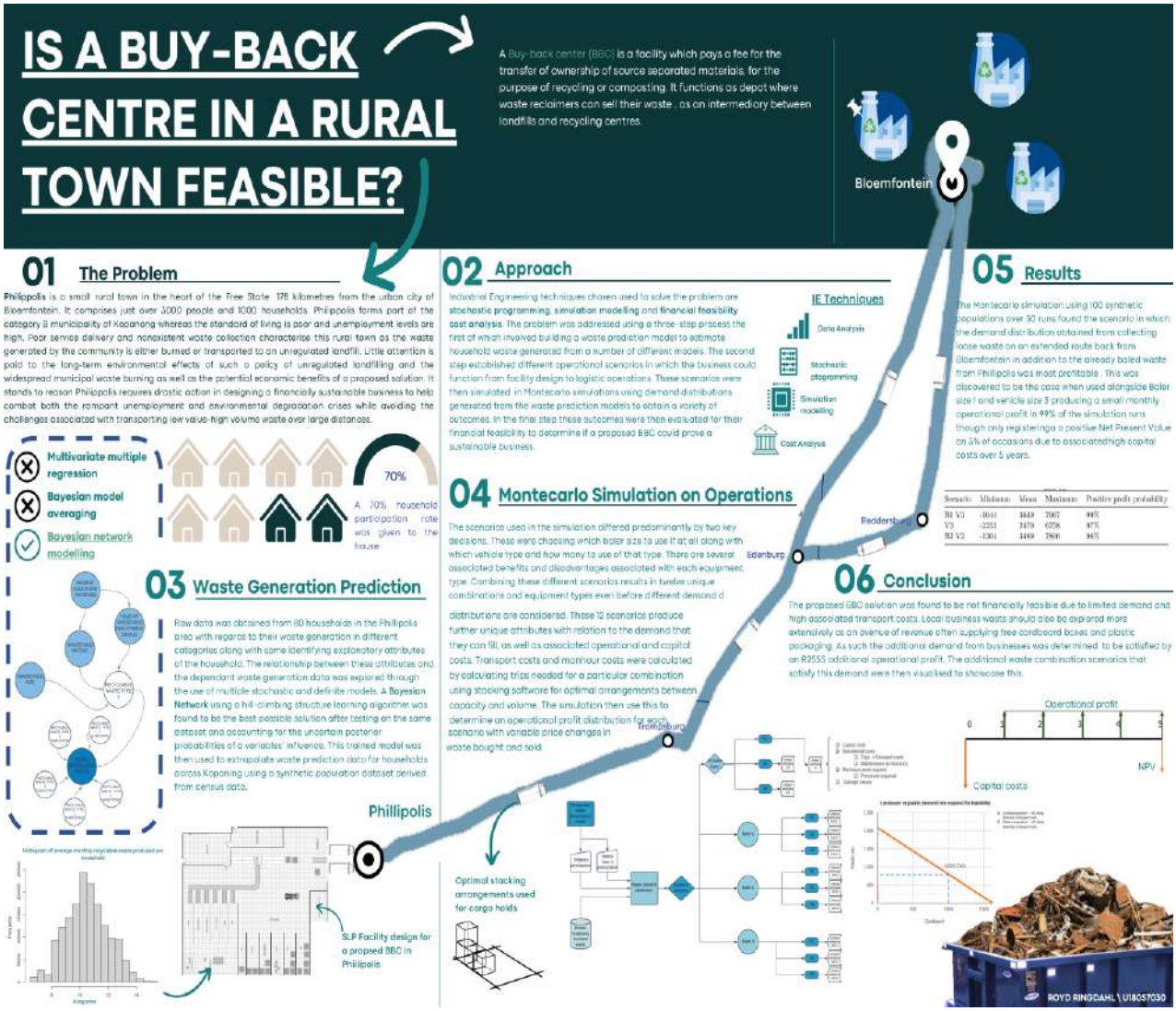

Figure 62: Visual representation of the feasibility of a BBC in Philippolis
Source: Royd Ringdahl

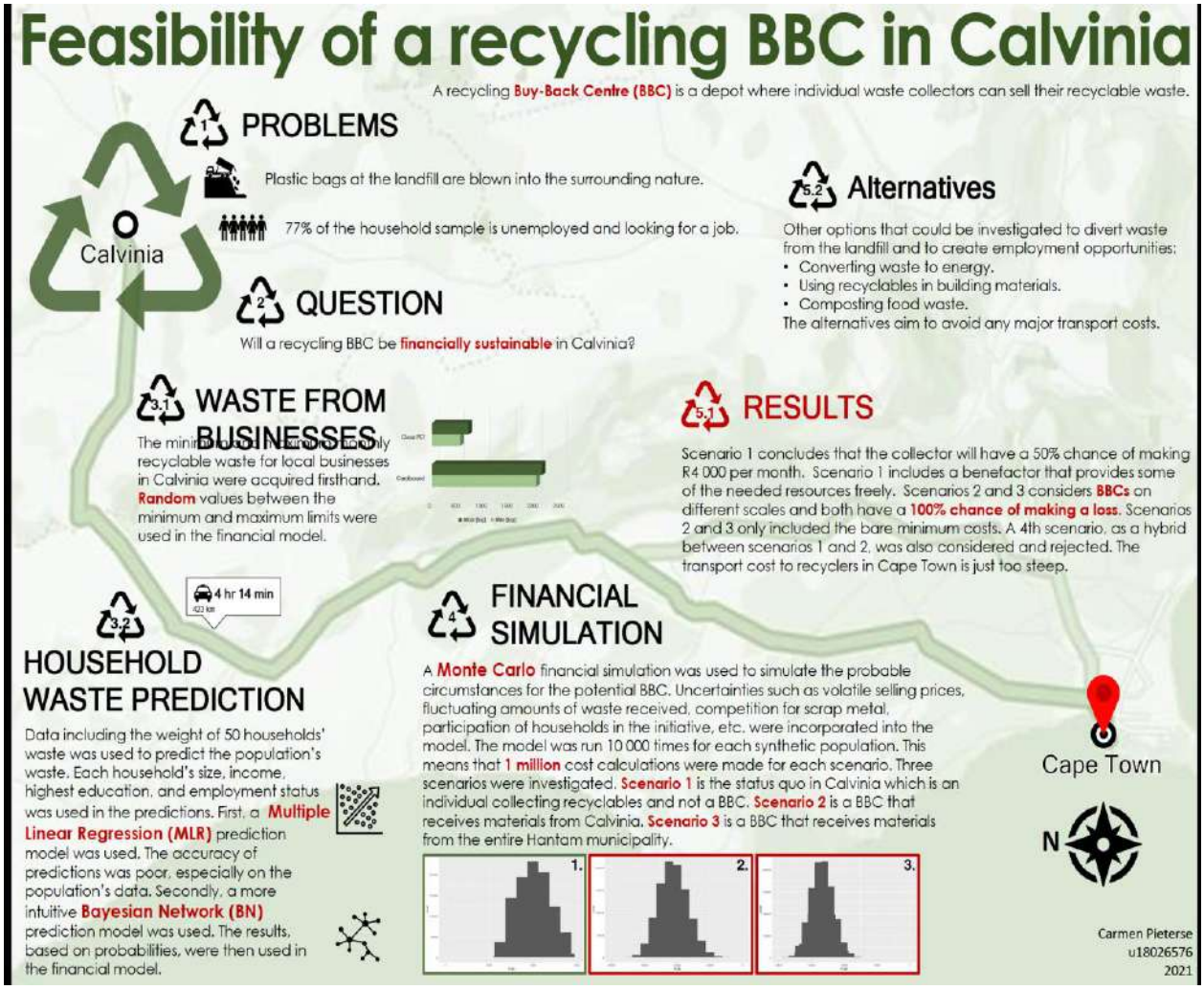

Figure 63: Visual representation of the feasibility of a BBC in Calvinia
Source: Carmen Pieterse

Both studies found that the major factors which make BBCs in these towns not feasible are the limited quantity of recyclables available and the exorbitant transport costs. A traditional BBC, which pays collectors for the recyclables, would not be economically feasible. Given the fact that a person, like "Tannie M" and "Oom G", can generate an income (however limited) for themselves should not rule out creative ways of collecting and selling recyclables instead of landfilling them, such as creating 'sharing economies',[9] in which individuals or a group of entrepreneurs can collect waste fractions and share space and facilities, such as baling machines and transport.

5 Summary and Discussion

This research project aimed to understand the perceived reasons for dirty cities and towns in South Africa, to generate constructive proposals to promote clean cities and towns, and to explore strategies to stimulate behavioural change related to waste management. To address these objectives, a variety of

[9] The notion of the sharing economy is based on the exchange, the sharing, and collaboration between individuals of goods, services, resources, time or knowledge, with or without monetary exchanges https://climate.selectra.com/en/environment/sharing-economy

data concerning the complex challenge of waste management, littering and illegal dumping were collected in four townships in four South African provinces, as well as in a township in the CoCT - Fisantekraal. We have aimed to provide a holistic, structural and systemic view on the issues of waste management, littering and illegal dumping.

This study can be regarded as a unique basic groundwork research project as the researchers have spent three years in the five townships in an attempt to understand the experiences and perceptions of the residents concerning waste and waste management. We explored what kind of waste the households generate and which type of waste they struggle to manage. We mapped and analysed the illegal dumping spots and listened to residents' perceptions and experiences with regard to waste and waste management, littering and illegal dumping in the townships.

The results obtained from the case studies provide a unique view of the complexities of waste management in South African rural and urban townships with lower-income status. The exploratory case studies confirmed previous research, concluding that the condition of dirty cities and towns encompasses more than the intentional behaviour (Ojedokun, 2022) of individuals or communities. In fact, undesirable waste disposal behaviour (i.e. littering and illegal dumping) is a complex, multifaceted and multi-layered challenge. It relates to individual traits and behaviour, cultural practices, socio-economic, political and infrastructural factors, as well as insufficient, ineffective, inappropriate and unequal (compared to more affluent and urban areas) service delivery. Conventional engineering-driven waste management was not designed for townships and informal settlements in developing countries such as South Africa – metaphorically speaking that is like trying to fit a square peg into a round hole in some instances.

Some scholars submit that every political, social and economic system should generate conditions conducive to the adequate satisfaction of fundamental human needs (Max Neef, 2010) in order to increase human capabilities and freedoms (Sen, 1999). In the context of South Africa, it is not only the participating townships that experience multiple FHN-based poverties and conditions not conducive to the satisfaction of these needs. It is a national phenomenon with historical and political causes (Du Toit, 2017). According to Botes (2018), 2 million people in South Africa protest annually against lack of housing, poor or non-existent service delivery - which includes issues such as waste management - authoritarian governance, and non-responsive, non-caring and corrupt government officials. These aspects were confirmed by the research results. The presence of indicators of the social disorganisation theory, such as overpopulation, urbanisation, poverty, unemployment, inequalities, vandalism, crime, violence and social disconnectedness, prepare the ground for (among other things) littering and illegal dumping, while the urgent need for houses, water and other necessities overshadows the urgency of good waste management.

Thus, what are the major **findings** of this study and its **recommendations**?

1. Illegal dumping in communities can be ascribed to the communities' attempt to manage their household waste. Often the 'offenders' do not intend to commit offences and contravene the law. (This excludes people who deliberately do not want to pay gate fees). The reasons for illegal dumping also include the fact that some people are ignorant, careless and negligent, as emphasised by all groups of participants.

2. Reasons for littering, in contrast to those for illegal dumping, are not related to communities attempting to manage their household waste as best they can, but are the result of a lack of education and awareness around the consequences of littering, because littering is often regarded as being socially acceptable ("everybody does it"), or because of an uncaring attitude and/or perception and intention that littering leads to job creation.
3. Engineering-based township waste management, if delivered, is metaphorically like trying to fit a square peg into a round hole. Too little attention is paid to township infrastructure not being responsive to conventional waste management solutions and related waste disposal behaviour choices. Despite the fact that in some of the townships good attempts are being made to address the shortcomings of the waste disposal systems, this urgently requires different and innovative approaches in collaboration with the residents, civil society, NGOs, private sector, informal sector (e.g. street vendors, waste pickers) and other stakeholders (UNEP, 2018)
4. Poverty, inequalities, unemployment, criminality (vandalism) which prevail in such communities as described in this study, pose major threats to social cohesion, positive waste behaviour, waste management and infrastructure. There is a great need for building socially cohesive environments. SDG 16 regarding peace, justice and strong institutions comes to mind.
5. Shortage of housing, which leads to informal settlement, overpopulation and backyard structures, requires attention for effective waste management planning.
6. Although waste management might not be the highest priority for communities in which there are so many other shortages, this does not mean that clean environments are not critically important. Adequate budgets, competent and dedicated officials, as well as collaborative planning and implementation should be prioritised (also see Kirsten & Fourie, 2021).
7. Transport and transport costs are major hindrances towards establishing efficient waste governance systems.
8. Of the major themes which were expressed, one related to the experiences and concerns about non-caring, corrupt government officials. Therefore, a people-centred and engaged orientation towards waste management is necessary, which requires development of trust, as well as community experiences of care and competency.
9. There is a need to determine the most effective way to communicate with the communities about sharing waste information, education and awareness.
10. Innovative local solutions should be found for collections and management of waste.
11. There is willingness and competence to sort and recycle waste and the participating residents were skilful sorters of waste after they had been trained. This positive orientation should be consolidated and encouraged. 'Citizen Science' in waste and waste management can be encouraged
12. Income opportunities in cleaning, as well as recycling opportunities, should be considered for local residents first before contracting outside agencies.
13. Solutions, such as mini drop-offs or skips, become sources for dumping if not well managed and regularly cleaned. Municipalities and citizens can work towards taking co-responsibility.
14. Investigating "community policing" opportunities to curb vandalism and crime might deliver good results.
15. Difficult waste fractions, such as dead animals, bulky waste, diapers, C&D and garden waste, are problematic to manage in lower-income and over-populated communities if residents do not have access to transport or other ways and means of managing such waste. Innovative solutions to

manage these difficult fractions need to be developed **with** the communities. Possible income opportunities might be created.

16. The differences in the types of waste generated reveal the clear differences in the cultures and contexts (e.g. accessibility to food types). All townships were different in the food waste generated and managed. It is important to take cognisance of these differences.
17. Returnable bottles were seldom encountered because they are a source of regular income for the household, or for the children. This was also the case with the returnable PET bottles. Within the Extended Producer Responsibility (EPR) scheme, more returnable products may yield a better return rate.
18. The dumping of textiles needs further investigation as it is still not clear why clothing, etc. is dumped, as it is a waste fraction that can be disposed of in a bin - and yet it is found in the veld and in dongas.
19. There are few waste markets for rural areas, which limits recycling opportunities. It is necessary to explore opportunities to expand waste markets and/or find local solutions to dealing with waste instead of landfilling.
20. The results of the studies highlighted the possible reasons for dumping and littering in low-income townships. More in-depth qualitative discussions need to take place to really understand how residents experience and manage waste - in particular where limited or no waste collection takes place. Previously the type and quantity of waste could be dumped and burned, but now the waste produced is of such a nature and quantity that this practice is no longer viable.

Reflecting on the above extensive list, the implication of these findings is that waste governance systems in lower-income areas cannot be conducted in terms of business as usual. Consequently, we need to consider how to move from conventional engineering-driven waste management to transformational and engaged waste management/governance systems.

There are two scenarios that are worth considering.

Scenario 1: From conventional waste management to transformational, engaged governance in municipal contexts with a functional and robust state partner

Scenario 1 includes functional municipalities that need to move into townships and informal areas and create a more people-centred system, which we will refer to as an 'engaged waste governance system'. Engaged waste governance is an inclusive and collaborative form of governance that seeks to actively engage non-state actors in both service delivery and decision-making - be it residents, NGOs, the private sector or the informal sector (if active).

Figure 64: Collaborative engaged waste management
Source: Research data

Engaged waste governance covers a number of aspects, as outlined below.

1. **Participatory, inclusive and accountable** governance systems including public-private-people partnerships (Ahmed & Ali, 2006). This entails creating platforms for regular, consistent and appropriate engagement and communication with residents, and the implementation of local relevant solutions to local problems.
2. Reviewing, rethinking and reimagining (3Rs) p**olicies, programmes, projects and service delivery,** which include low-cost and low-tech solutions that can create **income opportunities** for the residents and informal sector instead of money flowing out of the community.
3. **Just, t****rustworthy and competent** leadership. According to Botes (2018:252), "[r]esidents need to see tangible improvements in their living spaces. Trust will be built when they experience genuine efforts by their local government, politicians and bureaucrats to be responsive, to fill the potholes, to provide serviced land, to deal with the sewerage running in the street, to collect the mountains of garbage and repair street lights which had not worked for months, to appoint qualified, skilled and caring managers, to do proper financial management and stop corruption, to stop political infighting, to enhance community engagement". Service delivery with respect to all these aspects needs attention. Collaborative governance can hold municipalities accountable for the poor, unjust and unequal service delivery (Du Toit, 2017; Du Plessis, 2021; Kalina, 2021).
4. Collaboratively finding solutions and income opportunities when managing the **difficult waste fractions,** such as bulky waste, organic and C&D waste, textiles, diapers, and dead animals. What kind of collection systems can be created to assist communities to manage these waste fractions?

What income opportunities can this possibly create? Proposed solutions are likely to be location-specific, driven by that specific community's needs and dynamics. The importance of collaboratively deciding on a course of action can therefore hardly be overestimated.

5. Efficient management of **budgets and the appointment of capable officials** within the municipalities for waste management and general service delivery.

6. Continuous facilitation and development of 'citizen science[10]', active citizenship and **of relevant and appropriate education and awareness** in the communities regarding waste and waste management (including recycling), management of difficult waste fractions, information systems about collection times, delays and problems which the municipality may experience, recycling opportunities, and possible income opportunities through recycling and cleaning.

7. Collaboration with schools, other government departments and NGOs to educate and make children in particular - but also adults - aware of the importance of respecting and caring for their environment, health and climate threats.

8. Rethinking and co-managing appropriate/relevant localised community 'policing' and law enforcement to prevent littering and illegal dumping in each area.

In summary, residents, the informal sector, civil society and the private sector want to and should become active partners in service delivery (including waste management). Ahmed and Ali (2006) found behaviour and attitude change in people and service agencies when they became partners. Accountability and responsiveness improve when residents, politicians, officials and service providers face one another on discussion platforms and in delivering services collaboratively. Guerrero et al. (2012), Davies et al. (2005), Kinantan et al. 2017) and Ahmed and Ali (2006) emphasise that these actors will only be able to implement engaged integrated waste management successfully if they work together in an enabling environment which consists of equal and empowered relationships among stakeholders which mutually enable, engage and encourage.

In summary, Solid Waste Management in every town/area should be localised and unique to the community's socio- economic context and needs (Zen et al., 2014).

Scenario 2: From conventional waste management to decentralised community-led service delivery when municipalities are in crisis and witness service delivery decline or when no waste management is implemented. 'Community-led' in this context includes persons and bodies such as residents, NGOs, civil society organisations, and the private sector.

Research locations in this study included an area with no service delivery and an area with a municipality in crisis and unable to deliver waste management services, among other things. This is, unfortunately the current trend in many rural towns in South Africa. The chances of a municipality, such as Kopanong, becoming effective and efficient are limited if there is no intervention from the provincial and/or national government to rectify the situation.

The National Waste Management Strategy (NWMS) is a mandatory prerequisite of the National Environmental Management Waste Act No. 89 of 2008 (DEA, 2019). The main goal of NWMS is to meet

[10] Citizen science refers to the process where citizens actively take part in research projects such as e.g monitoring air quality, waste collection, illegal dumping and littering processes

all the objectives set out in the Act to ensure that waste management in South Africa is effective and efficient and available to all its citizens.

In the case of no service delivery the legal framework currently allows for intervention only when the legal process is followed. Unfortunately, this may result in a protracted process, and may even appear as a deadlock, without immediate relief for affected communities. Community-led service delivery will have to take place within the parameters of the constitutional dispensation. Therefore, the legally mandated process will have to be followed to compel service delivery. Raising awareness to educate communities about the mandated legal approach to service delivery disputes should be encouraged. However, where local government remains unresponsive, the current legal process might take time and marginalise poorer communities. Policy directives to guide local residents in determining the maximum reasonable response time before legal action is initiated because of absent or ineffective service delivery would be welcomed. This will increase the possibility of success in further legal action. Guidance to residents in less affluent areas who cannot afford expensive legal services and court battles with local municipalities would also be beneficial and would, importantly, lead to addressing persistent inequalities. As Kalina states that "interventions that are designed for low-income communities or south nations [and] that are not accessible to the communities they are designed for, are not helpful and may even be harmful" (2021:1191).

We further acknowledge that interventions from provincial and national government are seen as a last resort, particularly in the light of the constrained approach mandated in terms of principles involving co-operative governance and intergovernmental relations as acknowledged in a decision of the High Court in 2021 (*South African Human Rights Commission v Msunduzi Local Municipality and Others* (8407/2020P) [2021] ZAKZPHC). Other solutions to speed up the investigation period before governmental interventions can proceed should be investigated. In the above case the court also affirmed that bodies, such as the Human Rights Commission, are not constrained in the same manner and can litigate on a community's' behalf when the constitutional right to a healthy environment is at stake (see *South African Human Rights Commission v Msunduzi Local Municipality and Others* (8407/2020P) [2021] ZAKZPHC 35 (17 June 2021). These bodies have a legal duty to promote, protect, develop and maintain human rights, and to monitor and assess whether these are being observed. Other action groups can also play a role in advancing the rights of destitute communities in need of municipal service delivery.

However, we ask, in the light of the National Waste Management Strategy, why it should be necessary to anticipate, and even to pre-empt, adversarial responses from local governments, such as the unfortunate development and interdict obtained by Koingnaas Municipality against its residents in another service delivery dispute involving potholes and leaking sewerage? Why would local governments not rather welcome community collaboration to address failures in service delivery? One of the strategic pillars of the NWMS 2020 is waste minimisation. In this regard the NWMS 2020 labels collaboration and partnering between the private sector and government as a "critical enabler" (2021:37). Moreover, the NWMS 2020 calls for "strong institutional arrangements" aimed at the development of decision-making processes to be accomplished through a collaborative and consultative approach involving not only government stakeholders, but also the private sector, research institutions and civil society (2021:17-18). It is therefore government policy to promote collaboration with communities. The question is how this collaboration can become part of the waste management process without first escalating into a dispute between local

government and the community. Academic scholars have called for collaboration and pointed out that poor communication between communities and local authorities, along with a lack of community participation and an absence of governmental strategies to involve them, contribute to the problem (e.g. Kubanza, Matsika & Magha, 2022). To address this problem, Kubanza, Matsika and Magha (2022) propose awareness raising, better and timely communication through, for example, frequent meetings and the appointment of a counsellor as mediator between local government and communities. These authors also point to the role of NGOs, CBOs and local leaders as stimulators of community participation. However, these proposals still assume a baseline of governmental involvement, collaboration and communication. The question is whether the national government will also explicitly address the issue of non-responsive government and a complete breakdown in waste management in further policy directives. Will there be options for local communities to establish basic waste management themselves that involves alternatives to legal action and more streamlined options for addressing non-existent service delivery?

Further research

Based on the conclusions, further research should therefore include the elements outlined below.

Based on Scenario 1: The development of public-private-people (PPP) partnership waste management efforts in communities where there is a political will, where there are officials and NGOs with the capacity and skills to conceptualise and implement innovative approaches to collaborative engaged waste management service delivery, including the municipality, residents, the informal sector, civil society, and the private sector (businesses and NGOs). This would include:

1. A literature review of local and global examples of engaged people-centred waste management efforts;

2. A review of current local and global examples of engaged waste management governance;

3. A review of the local and global policies and support structures for engaged waste management governance;

4. The implementation of participatory action research processes in developing engaged waste management governance systems.

Based on Scenario 2: The following research directions are suggested:

1. A literature review of local and global examples of community-led (as defined above) service delivery;

2. A review of local and global examples of community-led service delivery in action;

3. Determining the local and global policies and support structures needed for sustainable and community-led service delivery;

4. The use of participatory action research to develop examples of community-led waste management governance systems and processes.

In summary, local government can no longer be the only role player in waste management. The responsibility for clean environments must be shared and an engaged process where stakeholders hold each other mutually accountable, should be embraced.

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Council for Scientific and Industrial Research

Waste RDI Roadmap Implementation Unit

Meiring Naudé Road, Brummeria,
Pretoria, South Africa

Postal Address

PO Box 395, Pretoria, South Africa, 0001

Tel: +27 (0)12 841 4801
Fax: +27 (0)12 842 7687
Email: info@wasteroadmap.co.za

www.wasteroadmap.co.za

Department of Science and Innovation

Directorate: Environmental Services and Technologies

Meiring Naudé Road, Brummeria,
Pretoria, South Africa

Postal Address

Private Bag X894, Pretoria, South Africa, 0001

Tel: +27 (0)12 843 6300

www.dst.gov.za