A REVIEW OF THE CHALLENGES AND CONSTRAINTS ASSOCIATED WITH THE PROVISION OF SANITATION SERVICES IN URBAN INFORMAL SETTLEMENTS

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by

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EXECUTIVE SUMMARY

Introduction

Since 2000, the national government has embarked on a series of initiatives to reform water supply and sanitation policies. However, despite the progress made by local government, there are still over 3.3 million South African households (which is one in every five households) that experience substandard sanitation services (StatsSA, 2016). The purpose of this study was to understand the challenges and constraints associated with providing sanitation in urban areas and present policy recommendations to address these challenges.

The research focused on providing sanitation in informal settlements as there is clear evidence that most underserviced households in urban regions in the country are in informal settlements. The research methodology included a literature review followed by interviews with officials from four metropolitan municipalities responsible for sanitation provision, as well as interviews with key national stakeholders and community-based organisations that advocate for the interests of informal settlement residents. Financial modelling of the capital and operating costs required to service the backlog and future growth in these metros at varying service ratios and using differing technology types was also conducted.

Main findings

Literature review

The benefits of improved sanitation are globally recognised from both a social (health and safety) and economic perspective. There are still over 3.3 million households (one in every five households) in South Africa that experience substandard sanitation services (StatsSA, 2016). Internationally, and South Africa is no different, historical rapid urbanisation has led to the development of informal settlements. Poor sanitation was the result of the inability of housing and service provision to keep up with service provision. StatsSA (2016) estimates that 530 000 households in urban informal settlements and an additional 195 000 informal urban backyarders have inadequate or interim sanitation services. Approximately 65 000 households in urban informal settlements have no access to sanitation services and 607 000 households in urban informal settlements can only access a form of toilet shared with other households.

The literature documents a multitude of challenges with the servicing of informal settlements, including the need to de-densify and the inability to access land for this purpose. While international examples of successful sanitation programmes from Thailand, Nicaragua, Brazil, and India can be cited, many of these revolve around micro-finance and state-community co-production models, which have proved difficult to replicate in South Africa.

Multiple national programmes to eradicate the so-called bucket toilet have failed and these persist in many settlements (DHS, 2012). As a result, there have been several high-profile protests regarding the lack of sanitation in South African cities, illustrating how sanitation and politics are intertwined (Robins, 2013). Protests are not only linked to the lack of sanitation, but also around the inferiority of services that are provided.

The term backlog is used often in relation to sanitation, but is poorly defined. Backlog often refers to the lack of a facility, but equally important is providing a continued service, which is often hampered by a lack of focus on the maintenance, refurbishment and extension of the capacity of existing sanitation infrastructure (DWA & DHS, 2012).

There are several key role players involved in providing sanitation services in South Africa, which include the Department of Water and Sanitation, local government and the private sector. Importantly, the Department of Human Settlements also has a key role to play as a number of South Africans access sanitation services via the national housing programme. The lack of technical capacity at municipalities is a challenge that has affected delivery and sustainability of services negatively. Capacity in the sector is supplemented by civil society organisations, but mainly in the form of advocacy, community facilitation and rural sanitation implementation.

The state funding options for sanitation provision include municipal own sources (own revenue and borrowing) and intergovernmental capital and operating transfers (grants). The most relevant of these capital grants for sanitation provision in informal settlements are the Municipal Infrastructure Grant, the Urban Settlements Development Grant and the Equitable Share operating grant for ongoing operations and maintenance. Despite these grants being available, local government still faces the most significant funding gap in relation to water services infrastructure. The Department of Planning, Monitoring and Evaluation has estimated that R45 billion is required to provide basic sanitation services to unserved households with a further R31 billion being required to refurbish and upgrade existing facilities (South African Human Rights Commission, 2014). The current funding allocation of the Equitable Share grant to sanitation is well below the actual costs of providing the service (SALGA, 2009).

There are a number of appropriate technology options available on the market in South Africa – each with their own advantages and disadvantages. In recent years, there has been a flurry of new and innovative sanitation solutions entering the market, mostly offering off-the-grid solutions (DWS, 2015). However, the characteristics of these different options are not widely known and understood, and there is little appreciation of the long-term financial, environmental and institutional implications of operating and maintaining the various sanitation systems. There is a view that sanitation solutions other than sewered waterborne sanitation may be considered inferior (Pan, Armitage & Van Ryneveld, 2013).

The failure to provide an effective refuse collection system in high-density settlements affects the performance of sanitation facilities negatively. Waterborne systems have high maintenance requirements, while on-site systems need to be cleared of sludge, which may be hazardous. Communal ablution blocks require active maintenance and security to be safe and sustainable. A key component of the success of a technology is its acceptance by the users, which requires adequate community participation in the decision-making process. Sutherland et al. (2013) have noted that the main reason that the considerations of communities cannot be taken on is due to the urgency to provide sanitation solutions to informal settlements.

Interviews

Interviews with municipal officials revealed that coordination between the complementary mandates of the human settlements, and the water and sanitation departments in municipalities is a challenge. Decisions around settlement development and sanitation solutions are also subject to political influence. While there may be good reason for political decisions, changes in the political landscape can delay the delivery of services by the municipality.

Municipalities state that they are currently experiencing a funding shortfall between the funding required to operate, maintain and finance new infrastructure and infrastructure renewal. The shortage of capital is partly attributed to the levels of transfers being lower than they should be, and partly due to constraints regarding raising debt finance. Often the lack of political support within the municipality for requested water and tariff increases is a key limitation. The funding gap is expected to widen. The municipalities engaged in the study stated that they have ageing infrastructure that requires increasing amounts of capital investment. This position is further exacerbated by expenditure on maintenance and renewal being cut due to budget cuts. Expenditure that is being deferred could result in rapidly increasing costs of infrastructure renewal in future.

However, simply increasing the funding allocation to municipalities will not solve the problem. These institutions face systemic challenges that also need to be addressed to ensure that the additional funds are not wasted. Further to challenges already noted, municipalities may lack the capacity to deliver on additional capital projects as skilled practitioners retire or mover closer towards the age of retirement. Procurement processes can also delay service delivery.

All interviewees stated that permanent sanitation solution of choice for the municipality was a waterborne sanitation connection. However, due to various constraints, temporary solutions are widespread with each of the municipalities engaged having different approaches in providing such temporary sanitation solutions. Each of the technologies have their own merits and disadvantages based on the location, density, and site conditions of the settlement.

It is clear that all temporary solutions have their shortcomings. Most important of these are the access – distance and safety related – to shared toilets with this being particularly problematic at night due to safety concerns. Lack of ownership of toilets and weak performance by service providers lead to poorly maintained facilities, which are unpleasant to use or completely unusable. One reason for poor maintenance of facilities in informal settlements is that it is difficult for municipalities to gain access to do operation and maintenance tasks. It was noted that some of the temporary sanitation facilities have been in place for extended periods of time.

Long-term solutions in the case of informal settlements require the formalisation of these settlements so that they can be upgraded in situ. But, often this does not get enough political support and, in any event, the process of developing settlements in situ is long and complex. There several challenges that make it difficult for municipalities to upgrade informal settlements in situ. However, of the primary constraints identified, only a few represent insurmountable obstacles to permanent development on the site where the settlement is located (for example, where an informal settlement is located within the 1:50 year flood line of a river, in a wetland – particularly those of high ecological value – and where settlements are located within a servitude).

There appears to be conflicting views around the level of service that residents living in informal settlements are willing to accept. Some participants in the study stated that residents are not willing to compromise on service levels lower than full waterborne sanitation while others stated that residents living in informal settlements will accept temporary solutions if they work. But, there is universal agreement on the need for sound and persistent processes for community engagement around settlement development and sanitation solutions in particular. The evidence from the interviews is that the same level of service may work in one area but fail in another if proper community engagement processes have not been followed.

The community perspective revealed that some communities may feel animosity towards the municipalities due to the perceived lack of care in repairing infrastructure and a view that the situation is not going to be improved. Communities do not expect much from municipalities. Much depends on the commitment of the municipality to hold community meetings over planning and project implementation with representative community structures. It was believed that municipalities are reluctant to change the way they do things to respond to the needs of communities. This is reflective of the weak relationship between municipalities and civil society organisations, who have the potential to facilitate informal settlement upgrading projects.

The municipal perspective is that municipalities face the systemic problem of post-apartheid South Africa with a large portion living in poverty and being unable or unwilling to pay for services. The government has the obligation to provide services to poor households; however, the current economic climate makes it difficult for the government to raise revenue via taxes. This results in funding available to municipalities being inadequate to provide free services to residents and sustainably operate their business.

Financial modelling

The technology assessment found that the metros surveyed are implementing a range of options, from ventilated improved pits (VIP) to individual waterborne sanitation. There is no clear ideal technology and all have advantages and disadvantages in different circumstances. There is also no consensus on what sanitation technology would be considered acceptable. However, the financial modelling results indicate that there is substantial financial incentive to change the prevailing use of lower service technologies for sanitation provision in informal settlements.

The modelling of cumulative operating and capital costs over 20 years suggests that while chemical toilets (at one toilet to five households) have the lowest initial cost, after 2.5 years they are more expensive than on-site systems at a 1:1 ratio (like VIP latrines or urine diversion toilets). After 4.5 years, shared chemical toilets are more expensive than low-flush sewered sanitation at a 1:1 ratio with decentralised treatment. After 6 years, chemical toilets are more expensive than conventional waterborne sanitation at the same ratio. This means that for any settlement older than 4.5 years, low-flush waterborne sanitation provided to individual dwellings (where possible) is cheaper than providing chemical toilets. Substandard and costly technologies are used because settlements are considered temporary. But, evidence shows that most informal settlements have existed for longer than 3 years. A major barrier to providing sustainable and acceptable sanitation is therefore a shift among officials of thinking of informal settlements as temporary settlements that have to be provided with emergency solutions, to being permanent settlements that should be provided with permanent sanitation solutions.

The financial modelling also provided estimates for how much would be required to service existing and new informal settlements under various technology options and service ratios. Providing 1:1 service ratios to all settlements using the current technology mix was shown to be the most expensive and clearly unaffordable. While providing the current technology mix at current service ratios is the cheapest alternative, for fairly little additional funding, a low-flush or conventional waterborne sanitation service can be provided to all households: a far higher level of service.

If all four metros were to provide waterborne sanitation to informal settlement residents at a service ratio of 1:1, it would cost R18 billion in nett present value (2016) over 20 years, made up of R11 billion in capital costs and R7 billion in operating costs. In real terms, these four metros would have to spend a total of R832 million per year on capital expenditure to roll out this sanitation infrastructure, which is 44% of their current capital budgets for all sanitation. If these numbers are extrapolated to all metros, they would have to spend on average R1.2 billion (or 34% of current sanitation capital budgets) on informal settlement sanitation every year.

In terms of impact on water resources, supplying waterborne sanitation at a ratio of one toilet per household located in informal settlements would result in an increase in water demand of approximately 5% of the current water sales volume in the four municipalities. The national imperative to conserve water needs to be weighed up with the inequity of providing differing levels of service for different urban residents.

Conclusion

The challenges and constraints associated with providing sanitation in urban informal settlements are not technical: they are financial and socio-political. The financial challenges relate not to the availability of finance, but rather to the excessive costs incurred by treating informal settlements as temporary settlements. The socio-political dimension of this approach is that substandard technical options are provided without adequate consultation, which increases community resistance and prevents the type of cooperation required to enable higher levels of service to be implemented. Municipal officials lack the skills and the resources to undertake the required engagement and negotiation to implement an appropriate and acceptable solution. In many cases, intermediary organisations (non-governmental or

community-based organisations) undertake this facilitatory role. Interviews and literature evidence indicate that there is a large skills and capacity gap in South Africa for intermediary services in settlement upgrading and sanitation provision.

The cumulative life cycle costs of providing waterborne sanitation technologies in informal settlements coupled with the improved level of service offering provide compelling motivation for permanent solutions to be the primary choice for service in all settlements except for those in hazardous locations. This could be provided as a communal waterborne solution in the short to medium term. Sanitation provision should be considered a first step in the human settlement formalisation processes. This requires a greater level of commitment to in situ upgrading and an increase in capacity to plan, implement projects and manage these settlements together with communities.

Policy recommendations

The following policy recommendations are proposed:

- Prioritise municipal funding internally for sanitation.
- Revisit sanitation tariffs to increase revenue generation.
- Engage communities regarding settlement options.
- Allocate adequate resources to engagement and participation.
- Build capacity in the sector.
- Determine the permanence of a settlement at the outset of the investigation.
- Initiate sanitation as the first stage in a comprehensive formalisation process.
- Select appropriate technologies for the long term.
- Provide low-flush sewered waterborne sanitation in all but extreme situations.
- Consider the full water value chain in assessing the resource demand of sanitation interventions.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **III**

ACKNOWLEDGEMENTS ..... **VIII**

TABLE OF CONTENTS ..... **IX**

LIST OF FIGURES ..... **XI**

LIST OF TABLES ..... **XII**

ABBREVIATIONS ..... **XIV**

GLOSSARY ..... **XVI**

1 INTRODUCTION **1**

1.1 Purpose of the Study 1
1.2 Overview of the Report 1
1.3 Study Limitations 1

2 LITERATURE REVIEW **2**

2.1 Background and Context 2
2.2 International Experience 12
2.3 Policy and Regulation in South Africa 14
2.4 Institutional Aspects Relevant to South Africa 19
2.5 Financial Aspects Applicable to South Africa 23
2.6 Technology 30
2.7 Key Findings of the Literature Review 36

3 STAKEHOLDER ENGAGEMENT **38**

3.1 Institutional Challenges and Constraints 38
3.2 Funding Challenges and Constraints 41
3.3 Assessment of Technology Options 45
3.4 Upgrading of Informal Settlements 49
3.5 What Do Residents Want? 55
3.6 Summary of Stakeholder Engagement 58

4 FINANCIAL ANALYSIS **61**

4.1 Individual Technology Assessment 61
4.2 Assessment of Informal Settlement Sanitation in Four Metros 65

5 CONCLUSION **70**

6 POLICY RECOMMENDATIONS **72**

REFERENCES **74**

ANNEXURE A: STAKEHOLDER ENGAGEMENT **77**

ANNEXURE B: REVIEW OF URBAN SANITATION IN THE WESTERN CAPE – PHASE 2 BRIEFING DOCUMENT **112**

1 INTRODUCTION **113**

1.1 Purpose of the study 113

2 CONTEXT **113**

3 OPTIONS ANALYSIS **114**

4 SYNDICATED ANALYSIS REVIEW 115

4.1 Land, finance and institutions 115
4.2 Technology, innovation and regulation 121
4.3 Community 126

5 NEXT STEPS 130

5.1 Land, finance and institutions 130
5.2 Technology innovation and regulation 131
5.3 Community 131

6 TOWARDS AN ACTION PLAN 132

LIST OF FIGURES

Figure 1: Benefit cost ratios (Hutton, 2012) 3

Figure 2: Urban and rural population of the world 1950–2050 (United Nations, 2014:7) 4

Figure 3: Map showing percentage urban and location of urban agglomerations, with at least 500 000 inhabitants 2014 (United Nations, 2014:9) 5

Figure 4: Proportion of each country's urban population living in slums according to the United Nations habitat definition (Senn, 2013) 6

Figure 5: Total population access to sanitation in 2004 (UNEP, 2008) 6

Figure 6: Urban share of the national population (%) 1911–2001 (Vacchiani-Marcuzzo, 2005 in Turok, 2012) 7

Figure 7: Urban and rural sanitation classification per municipal category 11

Figure 8: Breakdown of urban backlogs by municipal subcategory 12

Figure 9: Structure of the LGFF 23

Figure 10: Capital finance availability by institutional grouping 28

Figure 11: International comparison of charges for water and sanitation in urban areas 42

Figure 12: Containerised CABs 48

Figure 13: A view of the inside of a CAB 48

Figure 14: Local community members engaged at Parkington informal settlement 57

Figure 15: Model structure 63

Figure 16: Comparative costs of technology options 64

Figure 17: Municipal sanitation provision – modelling schematic 67

Figure 18: Comparison of sanitation programme costs in informal settlements in four metros – NPV 68

Figure 19: Estimated growth in sanitation backlog – Western Cape (excluding the City of Cape Town) (left) and City of Cape Town (right) 114

Figure 20: Eradication of the sanitation backlog at a ratio of 1:1 – Western Cape municipalities (excluding the City of Cape Town) (left) and City of Cape Town (right) 115

Figure 21: Life cycle costs for different toilet technologies* 123

Figure 22: Cumulative cost of various technology options over time (not discounted) 123

Figure 23: Example decision matrix (Franceys, 1991) 124

Figure 24: Required shift in stakeholder roles 134

LIST OF TABLES

Table 1: Estimated economic cost of poor sanitation (WSP, 2011 and WSP, undated) 4
Table 2: South African urban and rural population (United Nations, 2014 Annex) 7
Table 3: Definitions of basic sanitation 10
Table 4: Challenges of providing a free basic service 16
Table 5: Institutional role players 19
Table 6: Civil society organisations 22
Table 7: Municipal funding options 24
Table 8: Transfers made to municipalities that can be used for water services (2016/17 allocations) 24
Table 9: Operating account balance for WSA subcategory 29
Table 10: Service level 45
Table 11: Temporary sanitation technology preferences 46
Table 12: Categorisation of informal settlements 50
Table 13: Primary constraints for providing sanitation in informal settlements 51
Table 14: Description of technology options investigated 61
Table 15: Source of costing data 62
Table 16: Capital costs applied in the analysis 62
Table 17: Summary of existing sanitation arrangements in informal settlements in four metros 65
Table 18: Modelled service provision scenarios 65
Table 19: Target for service access for Scenario 1 66
Table 20: Municipal engagements 77
Table 21: Engagements to obtain residents perspective 77
Table 22: Funding sources 83
Table 23: Experience with different technologies 83
Table 24: Technologies piloted by eThekwini 85
Table 25: eThekwini's experience with different technology 85
Table 26: Capital and operating costs for different systems 90
Table 27: Levels of service 91
Table 28: Advantages and disadvantages of different technologies 97
Table 29: Informal settlement dwelling count and sanitation status 113
Table 30: Summary of high level cost implications of 1:1 servicing 115
Table 31: Sanitation matrix criteria 125
Table 32: Arguments in favour of chemical toilets over waterborne options 126
Table 33: ISU non-governmental actors (Shisaka, 2015:14) 127
Table 34: Positioning of actors in respect of ISU (Shisaka, 2015:14) 128

Table 35: Dataset challenges and remedial modelling assumption 140
Table 36: Assumed capital costs 142
Table 37: Assumed operating costs 142
Table 38: Bulk sanitation costs 142
Table 39: Water consumption per user 143
Table 40: City of Cape Town water demand assumptions 143
Table 41: User interface technology options 144
Table 42: Treatment technology options 145

ABBREVIATIONS

Breaking New Ground	BNG
Chief Financial Officer	CFO
City of Johannesburg	CoJ
Community Ablution Block	CAB
Community Organisation Resource Centre	CORC
Community-based Organisation	CBO
Department of Cooperative Governance	DCoG
Department of Human Settlements	DHS
Department of Planning, Monitoring and Evaluation	DPME
Department of Water Affairs	DWA
Department of Water Affairs and Forestry	DWAF
Department of Water and Sanitation	DWS
East Rand Water Care Company	ERWAT
eThekwini Water and Sanitation	EWS
Expanded Public Works Programme	EPWP
Federation of Urban and Rural Poor	FEDUP
Financial and Fiscal Commission	FFC
Generally Recognised Accounting Practice	GRAP
Geographic Information System	GIS
Gross Domestic Product	GDP
Human Settlements Development Grant	HSDG
Informal Settlement Network	ISN
Integrated Development Plan	IDP
Integrated Residential Development Programme	IRDP
Local Government Fiscal Framework	LGFF
Member of Executive Council	MEC

Millennium Development Goals	MDG
Municipal Finance Management Act	MFMA
Municipal Infrastructure Grant	MIG
Municipal Infrastructure Investment Framework	MIIF
Municipal Services Strategic Assessment	MuSSA
Municipal Standard Charter of Accounts	mSCOA
Nett Present Value	NPV
Non-governmental Organisation	NGO
Orangi Pilot Project	OPP
Public Private Partnership	PPP
Regional Bulk Infrastructure Grant	RBIG
Regional services council	RSC
Shack/Slum Dwellers International	SDI
Social Justice Coalition	SJC
South African Local Government Association	SALGA
Strategic Framework for Water Services	SFWS
United Nations Children's Fund	UNICEF
Upgrading Informal Settlements Programme	UISP
Urban Settlements Development Grant	USDG
Ventilated Improved Pits	VIP
Water and Sanitation for the Urban Poor	WSUP
Water Services Authority	WSA
Water Services Infrastructure Grant	WSIG
Water Services Provider	WSP
World Health Organization	WHO

GLOSSARY

Development facilitators	Organisations such as non-governmental organisations who represent the interests of communities when engaging with municipalities. These organisations are then able to facilitate and develop shared solutions accepted by the municipality and community.
Informal settlement	An unplanned settlement on land that has not been surveyed or proclaimed as residential, consisting mainly of informal dwellings.
Urban area	A continuously built-up area with characteristics such as type of economic activity and land use. Cities, towns, townships, suburbs, etc. are typical urban areas. An urban area is one which was proclaimed as such (i.e. in an urban municipality under the old demarcation) or classified as such during census demarcation by the geography department of Stats SA, based on their observation of the aerial photographs or on other information.
Urban formal	Urban settlements (formal) occur on land that has been proclaimed as residential. A formal urban settlement is usually structured and organised. Plots or erven make up a formal and permanent arrangement. Services such as water, sanitation, electricity and refuse removal are provided; roads are formally planned and maintained by the council. Formal urban settlements include suburbs and townships.

1 INTRODUCTION

1.1 Purpose of the Study

Since 2000, the national government has embarked on a series of initiatives to reform water supply and sanitation policies. These reforms were aligned with decentralisation, which devolved the responsibility for providing sanitation to local government. However, despite the progress made by local government, there are still over 3.3 million South African households (one in every five households) who experience substandard sanitation services (StatsSA, 2016).

Thus, while progress has been made in providing sanitation in urban areas, there is a need to understand the current challenges and constraints that inhibit the delivery of these services. This will enable the development of interventions that are better placed to serve the needs of the communities and improve service delivery. A proactive approach is therefore required. The purpose of this study is to inform the development of a policy position that will help guide national urban sanitation delivery programmes and their implementation in growing urban areas.

1.2 Overview of the Report

The report consolidates and presents the findings from the different phases of the study. The report has thus been structured based on each phase that was completed.

Chapter 2 presents the literature review that was undertaken to inform the subsequent phases of work. Chapter 3 discusses the key findings from the stakeholder engagement phase of the study. Chapter 4 presents the methodology and findings from the financial modelling phase of the study. Chapter 5 presents the conclusions in response to the main research question. Chapter 6 proposes policy recommendations arising out of the findings of the study and policy implications based on all previously completed phases of work. Annexure A contains notes and details of engagements that were conducted with municipal officials and community-based organisations (CBOs). Annexure B presents a review of urban sanitation in the Western Cape.

1.3 Study Limitations

The study focused specifically on urban informal settlements. Case studies were made of four metropolitan municipalities, namely, eThekwini, Ekurhuleni, City of Johannesburg (CoJ) and City of Tshwane. While some of the findings of the study may be applicable to backyard dwellers and peri-urban informal settlements, these settlement types were not explicitly investigated. Rural sanitation is not covered by this report. The stakeholder engagements and the financial modelling were undertaken at city scale and, therefore, did not aim to provide insights or recommendations on specific settlements. The findings are intended to inform interventions that can be made at a municipal, provincial or national level to improve urban sanitation provision.

2 LITERATURE REVIEW

This section of the document provides background and context to the sanitation problem based on research that has been previously undertaken. The importance of resolving the sanitation problem in urban areas and an indication as to the scale of the problem in urban centres is also discussed.

2.1 Background and Context

2.1.1 Why is sanitation important?

The importance of sanitation is well recognised by the global community, with the United Nations spearheading popular campaigns such as Sanitation for All[1] and Open Defecation awareness. Despite these campaigns and improved sanitation being one of the Millennium Development Goals (MDG), the United Nations (2010) estimates that there are still 2.5 billion people internationally who lack improved sanitation facilities, and over 1 billion people who practise open defecation.

Impact of sanitation on health and well-being

The relationship between sanitation and health is inextricably close; so much so that the British Medical Journal reported sanitation as the greatest medical milestone since 1840 (Mara, Lane, Scott & Trouba, 2010). Sanitation, which is broadly defined as safe disposal, implies that people must not only excrete hygienically, but also that their excreta must be contained or treated to avoid any adverse health effects. Sanitation helps break the faecal-oral transmission route that perpetuates public health problems (UNDP, 2006).

Poverty in infancy is closely linked to diseases associated with poor sanitation, which accounts for 10% of global diseases. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) report that diarrhoeal diseases are the cause of 1.6–2.5 million deaths annually, of which 750 000 deaths are children under the age of five. In sub-Saharan Africa, diarrhoea is considered the third-biggest cause of child fatality in children under the age of five years. Safe disposal is critical to child survival. Improved sanitation reduces child mortality by 50% and the risk of diarrhoea by 23% (Mara et al., 2010; United Nations, 2015).

Although diarrhoea is the most prominent disease, cholera, typhoid, hepatitis, worm infestation, reduced physical growth, impaired cognitive function and undernutrition are also associated with poor sanitation (United Nations, 2015). Studies report that improvement in sanitation reduces diarrhoeal diseases by around 35%. Studies show that the step from open defecation to fixed location sanitation reaps the biggest health and social benefit and is also the most critical and cost-effective. Thereafter, subsequent sanitation improvements yield smaller incremental health benefits. Since hygiene, safe water and sanitation are mutually supportive, sanitation is likely to improve when similar measures are undertaken in safe water supply and hygiene (Mara et al., 2010).

Sanitation does not only affect health and mortality rates but also provides wider welfare benefits including privacy and dignity. For women, the provision of sanitation reduces the threat of sexual violence, and teenage girls are less likely to miss school by staying at home during menstruation (United Nations, 2015). In informal settlements in South Africa, people are vulnerable to assault, robbery or even murder and, therefore, visiting outside toilets at night is all-too-often a dangerous activity.

1 World Toilet Day: 19th November

Economic impact

The investment in providing sustainable sanitation solutions has significant benefits in terms of community well-being, reduced health costs and improved household productivity (DWA & DHS, 2012). In many areas of the country, the sanitation service provided is not sustainable. The impact of the failure of the system has the greatest impact on the health and dignity of the poorest in this country.

The World Bank estimates that for every US$1 dollar spent on sanitation, there will be a return of US$5.50 in economic benefits because of a healthy and productive population. Globally, an estimated $260 billion in global gains can be achieved from improved sanitation. Underlying these economic values is the notion that improved sanitation leads to lower health care costs, fewer days lost at work and school, and less time spent queuing for shared sanitation facilities or finding areas for open defecation.

The health costs of treating diarrhoea are a burden on budgets. In sub-Saharan Africa, 12% of the total health budget is spent on treating preventable infectious diarrhoea diseases. Furthermore, at any one time around half of hospital beds are occupied by people with diarrhoeal diseases.

The impact of malnutrition on impaired school performance and delayed entry into the labour market affect nations' overall economic productivity and increase the societal cost to 9% of gross domestic product (GDP) (Bartram & Cairncross, 2010). By meeting the MDG sanitation target, children could gain 200 million days of school attendance globally.

The WHO estimates that people spend 30 minutes per day queuing for public health facilities or seeking secluded places for open defecation. This unproductive time could be spent working, studying, caring for children, engaging in collective efforts or resting. This time has an estimated economic value of US$100 billion per year (United Nations, 2008).

A cost-benefit analysis conducted by the WHO shows that the benefits of sanitation intervention outweigh the costs at a societal level (see Figure 1).

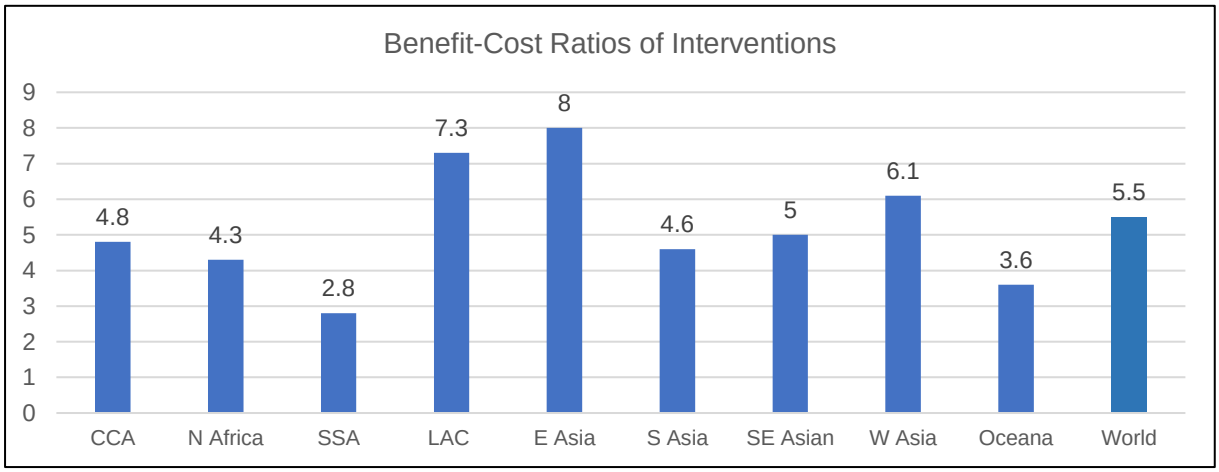

Figure 1: Benefit cost ratios (Hutton, 2012)

The Water and Sanitation Programme piloted one of the first studies to attribute a monetary value to a country's losses from poor sanitation. The negative impact of health and the contamination of water resources were the main contributing factors for the overall economic losses in East Asia. Table 1 indicates the key findings in East Asia.

Table 1: Estimated economic cost of poor sanitation (WSP, 2011 and WSP, undated)

Country	Estimated Economic Cost	Proportion of GDP
India	US$53.8 billion/a	6.4% GDP (2006)
Cambodia	US$448 million/a	7.2% GDP (2005)
Indonesia	US$6.3 billion/a	2.3% GDP (2005)
Lao	US$193 million/a	5.6% GDP (2006)
Philippines	US$1.4 billion/a	1.5% GDP (2005)

2.1.2 Why focus on urban sanitation?

International trends on sanitation

Globally, 54% of the world's population reside in urban areas, with forecasts predicting this to reach 66% by 2050. As depicted in Figure 2, the urban population overtook the rural population for the first time in 2007. This is in stark contrast to the 1950s, where 70% of the global population resided in rural areas (United Nations, 2014). While Africa and Asia remain mostly rural (40% and 48% urbanised respectively), they are urbanising faster than any other regions and expect to become 56% and 64% urbanised by 2050.

However, it is misleading to say that the rate of urbanisation is increasing since the average rate of urban growth is increasing at a decreasing rate internationally (Figure 2). In South Africa, the inter-census (2001–2011) rate of urbanisation was 2.7% for the country as a whole, and 3.2% in the metros (StatsSA), but had decreased to 2.4% for the country by 2015[2]. Nevertheless, the absolute size of the increments in which urban areas are increasing is what is of interest (UNPF, 2007).

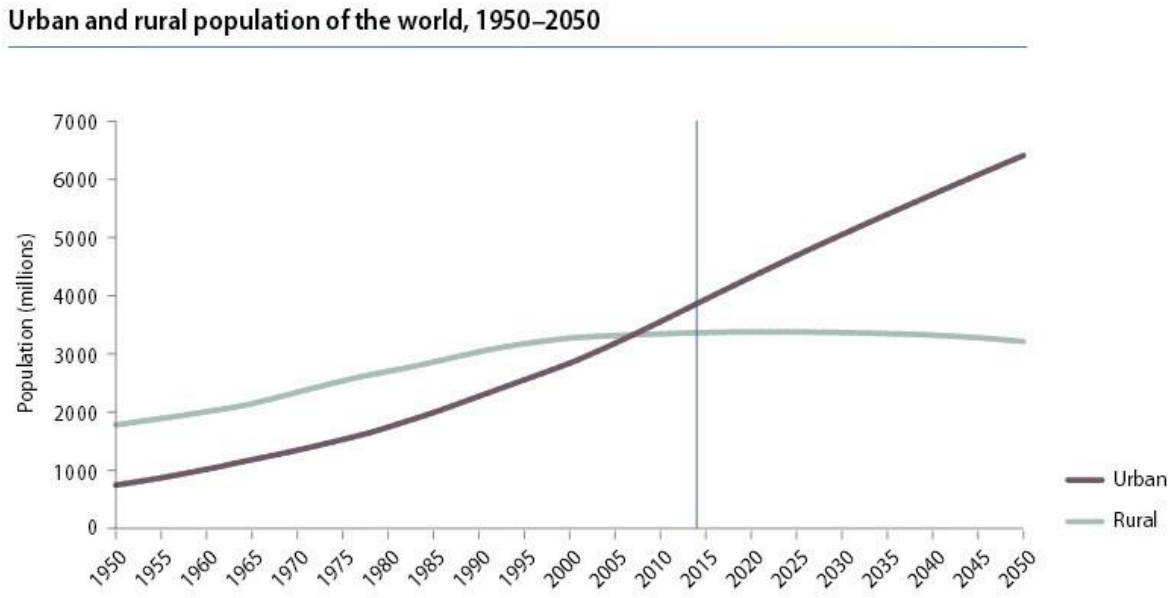

Figure 2: Urban and rural population of the world 1950–2050 (United Nations, 2014:7)

2 http://www.tradingeconomics.com/south-africa/urban-population-growth-annual-percent-wb-data.html

Although developing countries have lower levels of urbanisation, they have 2.6 times as many urban dwellers as developed countries (UNPF, 2007). It is the medium-sized cities and cities with a population of less than a million that are growing the fastest, not the mega-cities such as Tokyo (population of 38 million), Delhi (population of 25 million) and Shanghai (population of 23 million). Accordingly, 52% of the world's urban population live in settlements of less than 500 000 (Figure 3). It is the smaller cities that continue to absorb the urban population. These cities often do not have the capacity to deal with the related challenges. They are generally unable to deliver adequate housing, transportation, piped water, sanitation, waste disposal and other services (United Nations, 2014).

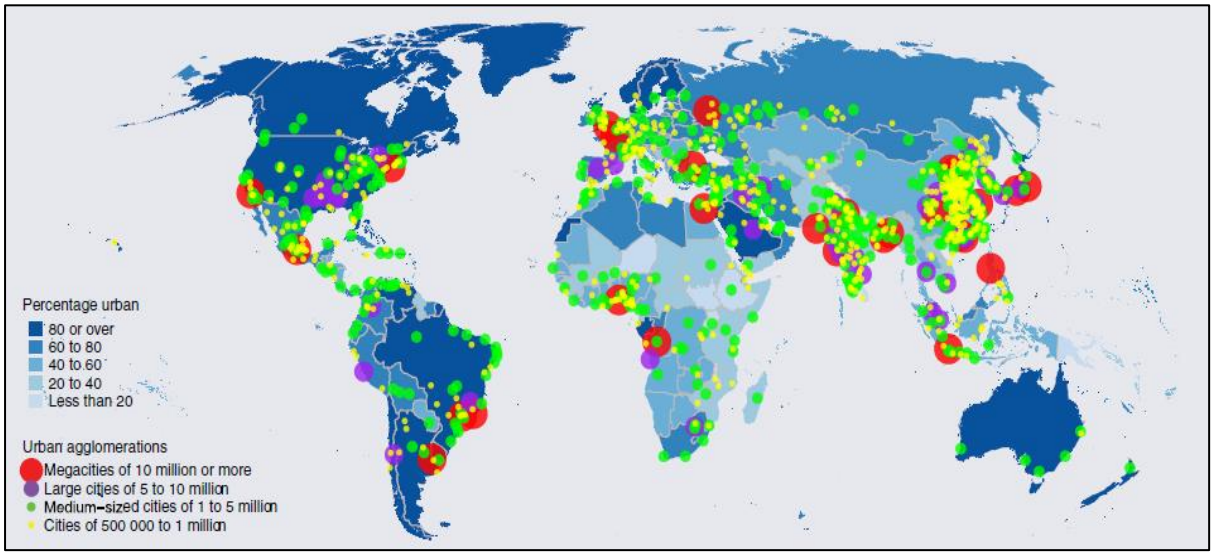

Figure 3: Map showing percentage urban and location of urban agglomerations, with at least 500 000 inhabitants 2014 (United Nations, 2014:9)

Senn (2013) recognises the four main drivers of global urbanisation: the natural demographic growth of urban populations; the absorption of rural settlements located at the edges of expanding cities; the transformation of rural towns into urban areas; and the migratory movements from rural area to cities.

Consequences of urbanisation

As the world continues to urbanise, sustainable development goals become more challenging. Reports show how urban areas are more unequal than rural areas and that hundreds of millions of the world's urban poor live in substandard conditions (United Nations, 2014).

The United Nations claims there are 828 million people living in informal settlements or slums around the world. This equates to one out of every three city dwellers or a sixth of the world population (United Nations, 2014). The proportion of each country's population living in slums is shown in Figure 4. Water and Sanitation for the Urban Poor (WSUP) maintains that this figure grows by 6 million people per annum (United Nations MDG Report, 2010 in the WSUP, 2015). Moreover, in some of the world's poorest countries, the proportion of the urban poor is growing faster than the overall rate of urban population growth.

In sub-Saharan Africa, urbanisation is synonymous with the growth of slums. An estimated 72% of the region's urban population live under slum conditions. Government authorities thus face a major challenge at providing adequate housing, and water and sanitation services to growing urban populations.

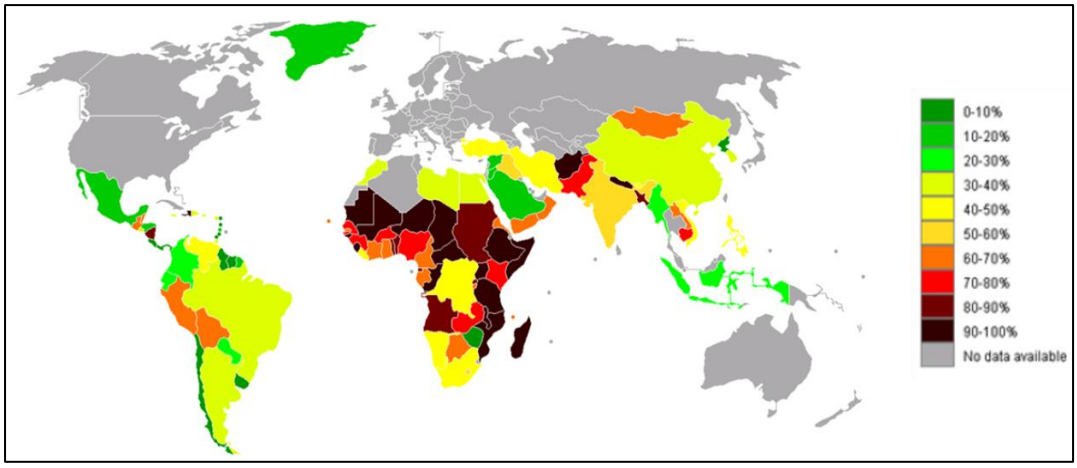

Figure 4: Proportion of each country's urban population living in slums according to the United Nations habitat definition (Senn, 2013)

Large numbers of urban residents suffer from environmental and health challenges related to drinking water, sewage facilities and solid waste disposal (Cohen, 2006). The United Nations reports that the state of water services in developing countries is inadequate. Although upper and middle income urban residents receive services, the rapidly expanding settlements on the urban fringes are left behind.

There are major challenges in water and sanitation provision in slums. Since they are densely populated areas unguided by urban planning, there are practical challenges around the expansion of water and sanitation networks. The low tenure security results in large investments being unfavourable. The high poverty rates of the residents mean that they are unable to pay for the services. Also, the relative distance of slums, often located on the fringes of the cities, make services costly to implement.

Figure 5 shows a global picture of access to sanitation and it corresponds closely to Figure 4, which indicates the extent of slums.

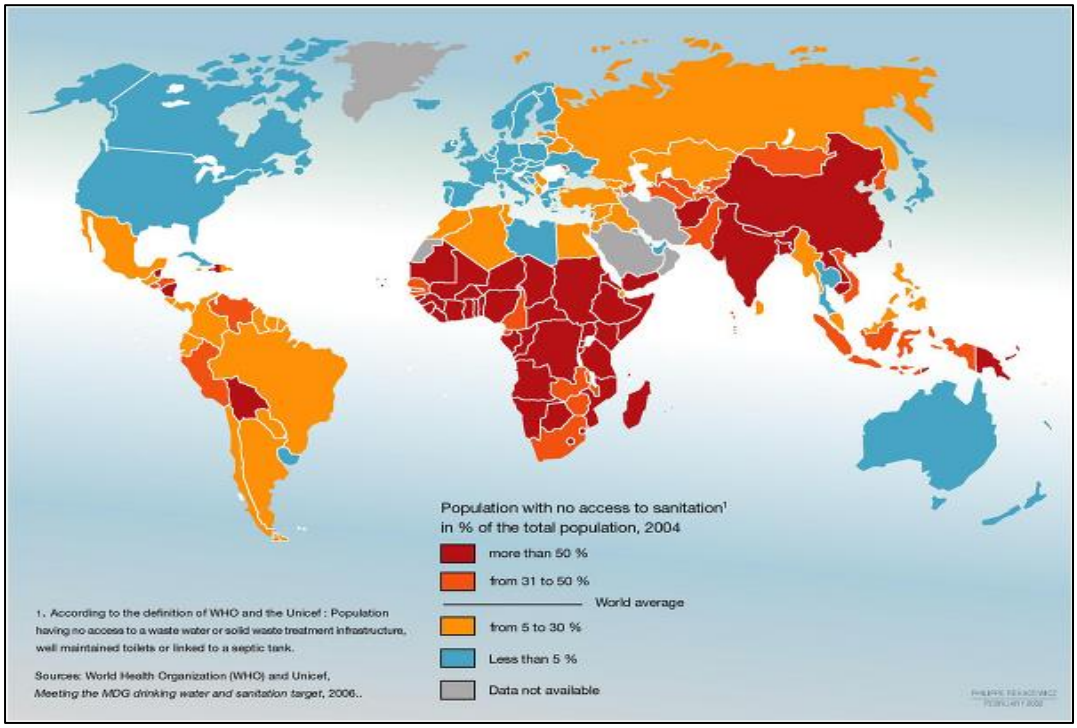

Figure 5: Total population access to sanitation in 2004 (UNEP, 2008)

Consequences of urbanisation

Two-thirds of South Africans reside in urban areas; an increase from 52% in 1990. Given that people are freer to move around in post-apartheid South Africa, and the economic activity produced in cities, urbanisation has increased since the 1990s (Urban Landmark, 2013). Forecasts estimate that by 2050, 77% of the population will reside in urban areas (Table 2).

Table 2*:* South African urban and rural population (United Nations, 2014 Annex)

Urban population (thousands)			Rural population (thousands)			Proportion urban (%)		
1990	2014	2050	1990	2014	2050	1990	2014	2050
19 146	34 168	49 103	18 972	18 972	14 303	52	64	77

There is an inter-relationship between migration and urbanisation and the historical legacy of apartheid. The discriminatory migration and urbanisation controls explain the lack of significant migratory changes and the rather flat slope from the 1950s to early 1990s as indicated in Figure 6. Similar to global trends, secondary cities in South Africa have experienced the most growth in urbanisation. Polokwane, Rustenburg, Emfuleni, Nelspruit and Ekurhuleni experienced an average annual population growth rate of between 1.6% and 2.9% over the past decade, while in comparison, Cape Town has grown at 1.4%.

The overall population in South Africa has grown 15.5% (almost 7 million) in a decade and Gauteng has had the biggest and fastest growing population, increasing 33.7% since 2001 (Urban Landmark, 2013).

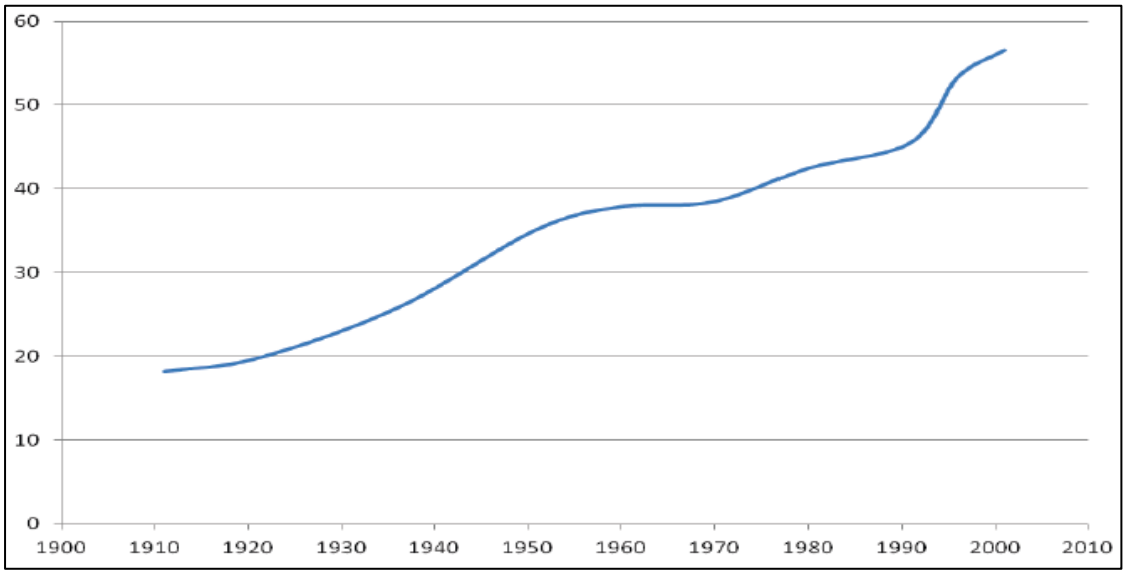

Figure 6: Urban share of the national population (%) 1911–2001 (Vacchiani-Marcuzzo, 2005 in Turok, 2012)

The impact of urbanisation

The migration to urban cities and the internal growth of cities have exceeded new job creation (Victor, 2009). In addition, the increasing urban population and decreasing household size have put pressure on government to meet the ever-increasing housing demand. As a result, informal settlements have expanded in size and multiplied in number with an estimated 2700 shack areas that house 1.2 million households (SACN, 2011 in Turok, 2012).

The metropolitan areas are under pressure due to migration and, thus, despite national housing programmes, the total number of informal dwellings rose from 0.9 million to 1.1 million between 2002 and 2010 in Gauteng metros (Turok, 2012). In the same way, Gauteng metros have not kept pace with the provision of sanitation services over the same time.

Carden et al. (2009) illustrate the impact of urbanisation on the delivery of sanitation services in the City of Cape Town. An increase of 1 million people between 1996 and 2006 (40% growth since 1985) has posed challenges in providing water-related services of water, sanitation and drainage. This has been exacerbated by ongoing migration and housing backlogs with an influx of 7700 households per annum (2007 figures) and a backlog of around 350 000 housing units.

In situ upgrading of human settlements is the development option preferred by the national Department of Human Settlements (DHS). However, given that the majority of upgrading of human settlements result in de-densification to some degree, relocation of a portion of households is often unavoidable (SAHRC, 2014). Thus, municipalities often have to procure additional land or use their own land to relocate a proportion of informal settlement dwellers.

Land acquisition for informal settlement relocations requires that land is found in close proximity to the existing settlement to ensure that the livelihoods of informal settlement dwellers are not disrupted severely. Poor relocation of a household can significantly increase household costs or travelling times to work, which disrupts social networks. This is a challenge for municipalities as the acquisition of well-located land is becoming increasingly difficult (Sutherland, Robbins, Scott, & Sim, 2013).

With forecasts showing a continued trend towards urbanisation, it is necessary for authorities to focus on delivering services in urban areas, particularly informal areas, to achieve sustainable human settlements.

2.1.3 The politics of sanitation

Access to good sanitation across the household income spectrum is considered an index of equality. History shows that poor access to toilets often triggers conflicts since it is this arena where social distinctions, (for example race, class, sex and religion) are maintained, inscribed and contested (Penner, 2010). Sanitation issues are complex and politically charged, and protest action is not merely over providing sanitation, but around the standard of such provision.

An illustration of South Africa's emerging politics of sanitation can be found in the 2011 "toilet wars" or "poo protests" in the City of Cape Town when, inter alia, members of the ANC Youth League encouraged the destruction of the corrugated iron enclosures of toilets in Makhaza informal settlements in Khayelitsha. The open toilet has since become a political symbol and a sign of indignity. It has brought the issues of sanitation to the forefront of political discourse (Robins, 2011).

Since the open toilet scandal, there has been a series of faeces-dumping protests in Cape Town. These have ranged from dumping faeces on the steps of the Provincial Legislature, Cape Town International Airport, Premier Helen Zille's convoy, the N2 highway and the Bellville Civic Centre (Ntabeni, 2013).

Professor Robins (2013) argues that sanitation and politics have always been intertwined. History shows how sanitary and hygiene laws were often used in colonial African states to displace the poor from middle-class centres to the urban fringes. In apartheid South Africa, sanitation was a key driver of segregation and the removal of District Six is an example of such practices. However, sanitation has taken time to enter the political space in South Africa, despite the continual increase of municipal service delivery protests since 2008. Robins (2011) attributes this to the histories of stigma and shame associated with poor sanitation, especially among the poor.

Why are communities protesting?

The lack of access to services, sanitation included, has contributed to South Africa experiencing a marked increase in the number of service delivery protests previously mentioned. For example, a group of women from Khayelitsha brought bags of faeces to dump on the steps of Parliament explaining that they were angry to be treated as third-class citizens with third-rate sanitation (Schutte, 2013). There is a perception by communities that any technology solution other than waterborne sanitation is inferior (Pan, Armitage, & van Ryneveld, 2013).

One national initiative to improve the situation was aimed at removing bucket sanitation systems. The Strategic Framework for Water Services (SFWS) established a target to eradicate the bucket system by 2006. The target was subsequently adjusted to 2014. A review by the DHS in 2012 revealed that many households still continue to use the bucket system (DHS, 2012). Municipalities have attempted to adopt dry sanitation systems in areas where bulk infrastructure was lacking, but many communities were unwilling to accept this, which is one factor why replacing the bucket system has taken much longer than initially envisaged (DWA & DHS, 2012).

A common complaint raised by communities is the lack of public participation and access to information (SAHRC, 2014). However, in principle, public participation is required with the DHS including this principle in the national housing programme. Further comment on the practical shortcomings of effective public participation relating to providing sanitation solutions is given later in this report.

Considering the commonly promoted solution to provide sewered sanitation systems, South Africa has made progress in expanding access to this type of service. But this has led to a new set of problems: for example, bucket eradication has resulted in overloading waste water treatment works due to discharges from thousands of new flushing toilets (SALGA, 2009). This highlights the challenge that municipalities may face when balancing community requirements with existing infrastructure capacity constraints.

2.1.4 Urban sanitation and informality

To a great extent, the urban sanitation problem is linked to the problem of informality. It is proposed here that households access sanitation through three primary pathways:

- Provision as part of planned formal property development. In the case of low-income housing, this is mostly under the ambit of the national housing programmes.
- Provision of a permanent solution as part of upgrading informal settlements.
- Interim sanitation provision in informal settlements.

Much of the discussion of the challenges and constraints related to sanitation provision in urban areas is related to the last two pathways and to the challenges and constraints of informality.

2.1.5 Facility or service?

The term ‘backlog’ is much used in South Africa but is often not clearly defined. The SFWS defines sanitation facilities and sanitation services as given in Table 3 (DWAF, 2003).

Table 3: Definitions of basic sanitation

Term	Definition
Basic sanitation facility	The infrastructure necessary to provide a sanitation facility that is safe, reliable, private, protected from the weather and ventilated, keeps smells to the minimum, is easy to keep clean, minimises the risk of the spread of sanitation-related diseases by facilitating the appropriate control of disease carrying flies and pests, and enables safe and appropriate treatment and/or removal of human waste and waste water in an environmentally sound manner.
Basic sanitation service	Providing a basic sanitation facility that is easily accessible to a household, the sustainable operation of the facility, including the safe removal of human waste and waste water from the premises where this is appropriate and necessary, and the communication of good sanitation, hygiene and related practices.
Sanitation services	The collection, removal, disposal or treatment of human excreta and domestic waste water and the collection, treatment and disposal of industrial waste water. This includes all the organisational arrangements necessary to ensure the provision of sanitation services, including the appropriate health, hygiene and related practices.

The sanitation challenge in South Africa can be separated into two categories, namely, providing infrastructure to households who do not currently have access to a basic sanitation facility, and households who have access to a basic sanitation service that is not operating at the standard required. The Western Cape study (see Annexure B) clearly indicates how differently the backlog would be quantified, and how the cost of potential solutions would vary if different servicing ratios were used. If a service ratio of one toilet to five households (1:5) is acceptable, then the backlog is far lower than if 1:1 is the targeted standard. Thus, the challenge is to ensure that all South Africans have access to a basic sanitation facility, and also to ensure that all South Africans have access to a basic service.

This is not a simple task and there has been a lack of focus on the maintenance, refurbishment and extension of the capacity of existing sanitation infrastructure (DWA & DHS, 2012).

The sanitation service delivery challenge can be further expanded, as noted at the Sanitation Indaba in Durban, to be a combination of the following (DWS, 2015):

- Service delivery backlogs.
- Refurbishment backlogs for infrastructure that is past its design life.
- Extension backlogs to provide a service to new households in the community.
- Upgrade needs to infrastructure that does meet the minimum standard.
- Operation and maintenance backlogs.

2.1.6 What do we know about the size of the problem?

Providing sanitation services to households has remained a challenge over the past decades. Nationally, the following backlogs in the sector have been noted in the latest 2016 Community Survey (StatsSA, 2016):

- 530 000 households in urban informal settlements and an additional 195 000 informal urban backyarders have inadequate or interim sanitation services.[3]
- 65 000 households in urban informal settlements have no access to sanitation services.
- 607 000 households in urban informal settlements can only access a form of toilet shared with other households.

What portion of the sanitation problem is urban?

Figure 7 displays the extent of the urban and rural sanitation backlog in each of the different municipal subcategories. The subcategorisation used here is that originally applied in the Municipal Infrastructure Investment Framework (MIIF) in 2004 and has become widely accepted. Local municipalities are classified into five categories:

- A: Metros.
- B1: Secondary cities.
- B2: Local municipalities with a large town as core.
- B3: Local municipalities with small towns and commercial farming rural areas, with relatively small population and significant proportion of urban population.
- B4: Local municipalities that are mainly rural with, at most, one or two small towns in their area. Land in the rural areas within these municipalities are typically communally owned.

Backlogs are defined as households who either have no access to a toilet facility or who use a pit latrine without ventilation, or who use the bucket system. This definition is based on access to a sanitation facility, not a sanitation service.

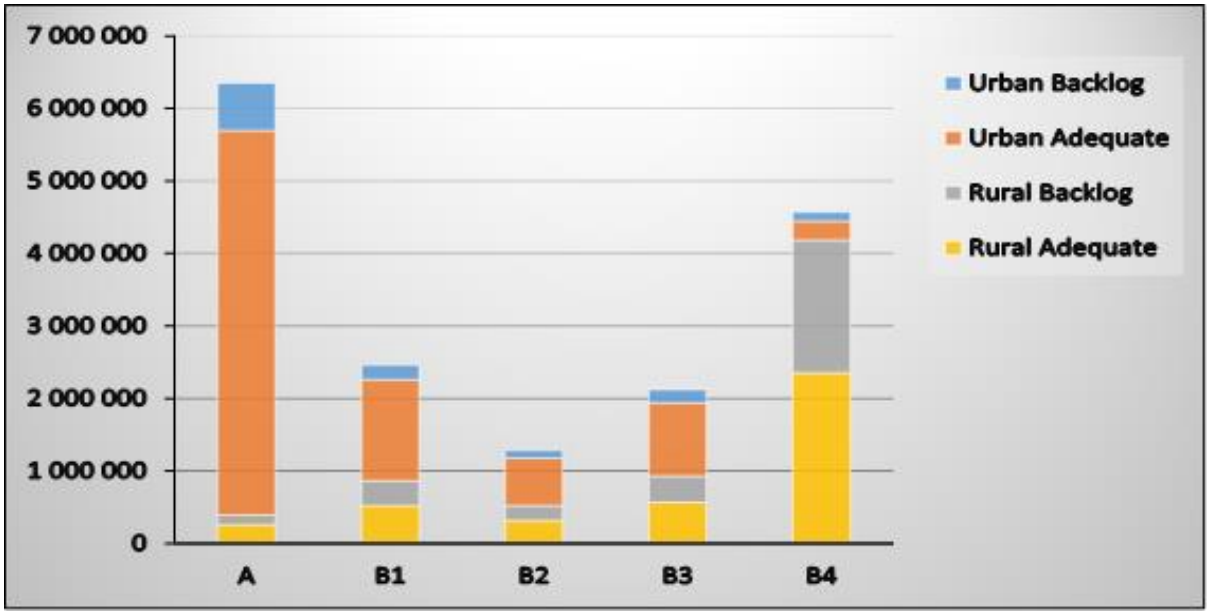

Figure 7: Urban and rural sanitation classification per municipal category[4]

3 Inadequate or interim is defined here as "a household with primary access to a chemical toilet; pit toilet without ventilation; or a bucket toilet".

4 Census 2011 data

Figure 7 highlights that nationally, the bulk of the sanitation backlog is located in the rural areas of B4 municipalities. However, the urban sanitation backlog constitutes 44% of the total sanitation backlog. In addition, 60% of the urban sanitation backlog is located in metropolitan municipalities as detailed in Figure 8.

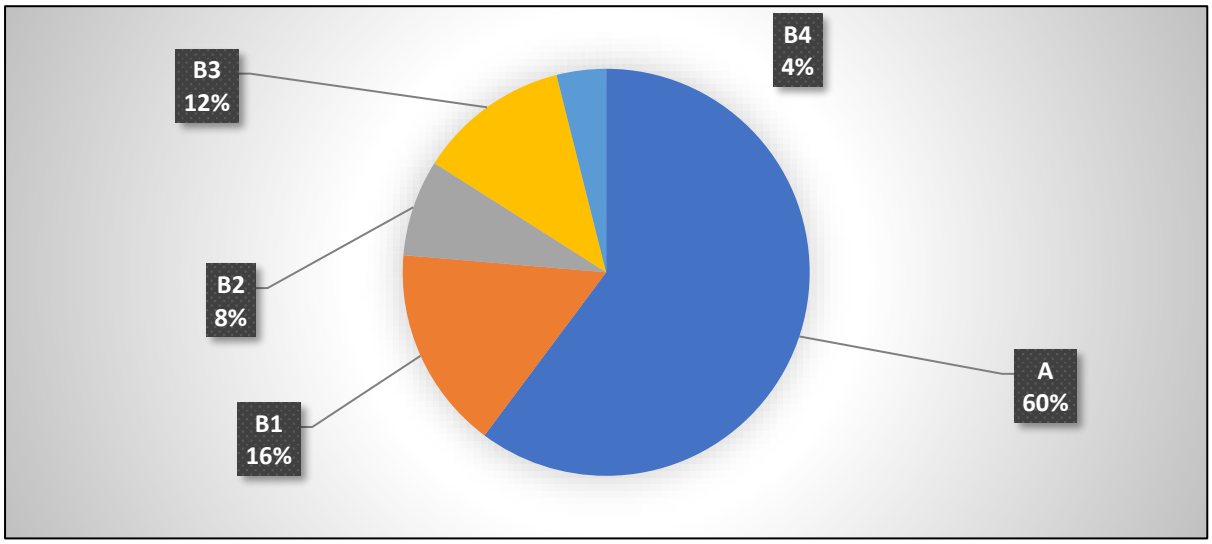

Figure 8: Breakdown of urban backlogs by municipal subcategory[5]

2.2 International Experience

2.2.1 City-wide programmes

Literature shows that provision of sanitation services at a national scale is often done in conjunction with housing programmes and slum and squatter upgrading. An example of such a programme is the national Baan Mankong slum and squatter upgrading programme in Thailand (Satterthwaite, McGranahan & Mitlin, 2005). The government (through the government's Community Organisation Institute) provides funding in the form of infrastructure subsidies and housing loans directly to poor communities.

Although it is a national-led programme, communities play the central role and, with the help from local government and civil groups, are able to find land solutions that work best for them in terms of location, price and tenure, and negotiate with the landowners. To be eligible, a community has to set up a savings and credit group and all the poor families in the community have to be members. Communities are also required to register themselves as community cooperatives to establish a collective legal entity that can take housing loans, receive other development subsidies and buy or lease land collectively (Boonyabancha, 2009).

The Baan Mankong programme recognises how land tenure and the provision of sanitation services are interconnected. Water utilities are often not allowed to provide services in informal/illegal settlements. Even where they can, they encounter practical difficulties (such as no official records and a lack of maps indicating ends of boundaries and plots). Households are also not inclined to invest in the provision themselves due to their insecure tenure. Since the programme's main focus is not on sanitation provision, the results have been mixed regarding the quality and extent to which the sanitation services are provided.

5 Census 2011 data

The PRODEL programme in Nicaragua is a similar national-led project whereby the government co-finances small infrastructure and community projects (provision of water, sanitation and drainage) and provides loans and technical assistance to households for home improvements and enterprises (Satterthwaite et al., 2005). The government receives external funding to finance the project, initially from Swedish International Development Corporation Agency, and more recently, from the Inter-American Development Bank (2012). Grants fund municipal community improvements in infrastructure while loans fund households' own construction or improvement programmes. PRODEL offers loans with payments tailored to projects and based on municipalities' and families' incomes.

Communities and municipalities enter into public private partnerships (PPPs). Together they vote on the most affordable and urgently needed infrastructure and fit the project within the municipality's overall development. Households are required to contribute financially and in kind.

Providing condominial sewers in Brazil is another example of a city-wide sanitation project. The innovative model, named the condominial sewer system, was developed in response to Brazil's expanding peri-urban neighbourhoods in the 1980s and introduced to many of the cities across the country. The layout is based on a shorter grid with shallower feeder sewers that run through backyards, and shallower connections to the main that ripple through the system. These innovations cut construction costs to between 20% and 30% of those of a conventional system. Individual households are responsible for maintaining the feeder sewers. The city's public water utility only maintains the trunk mains (Helmer & Hespanhol, 1997).

In the city of Brasilia, the funding for the project was provided by the Caixa Econômica Federal (Federal Development Bank) and the Inter-American Development Bank, along with contributions from the capital and federal district governments. The condominial branches, which account for 60% of the total cost of the expansion, were covered by the beneficiary communities, resulting in a significant reduction in the financial burden assumed by the utility company, namely, CAESB (Melo, 2005).

The water utility ensures that the fee structure for connection to and use of the condominial systems reflects the differential costs of the sewer options available to households, thus ensuring that the consumers benefit fully from the savings associated with the lower cost choices. The connection fee is equivalent to the actual average cost of the infrastructure construction for each type of condominial service (Melo, 2005).

2.2.2 Smaller scale projects

The Orangi Pilot Project (OPP) is a sanitary programme in India that provides technological and organisational support for residents to build sanitary latrines in each house, an underground sewer in each lane, and a collector sewer in each neighbourhood, which then feeds into a trunk sewer, which is provided by the state (McGranahan, 2013). This grassroots or bottom-up approach has fostered a system where local residents are willing to take on the responsibilities officially borne by the state. The OPP's relationship with local government has become closer over the years since working on the lanes requires collaboration with local government. The OPP has managed to influence a change in practices of public providers. Local government treats the OPP as an extension office and uses them as a source of local knowledge. The financing of the project is based on what communities can afford, and technologies are engineered to ensure the affordability of sanitation facilities. The underlying premise is that facilities are based on affordability and not on what households want or deserve. The cost of facilities is close to US$20 per household. Unlike other projects, the OPP sought to avoid external funding, because it often came with conditions that were costlier than locally developed solutions.

Mahila Milan, SPARC and the Indian National Slum Dwellers Federation is an alliance in India that focuses on the provision of public toilet blocks thereby providing sanitation to the poorest 30% who cannot make contributions for costlier individual sanitation facilities. The alliance was created when the

local government commissioned a collective of low-income residents to build a municipal toilet. The government gives funding to the project, in addition to providing permissions, capital costs and infrastructure. The key role of the alliance is to ensure that the unserved residents are at the forefront of sanitary improvement and drive the process. They do this by helping communities plan, construct and manage the toilets in their settlements. Communities take charge of identifying appropriate locations and benefit from having unlimited toilet use at a price that is considerably less than households would have to pay for prevailing pay-per-use toilets. The project has 1000 community-designed and managed toilet blocks with 20 000 seats (McGranahan, 2013).

The Slum Sanitation Programme in Mumbai is another community-based toilet project, which was funded by the World Bank and the Mumbai Municipality (McGranahan, 2013). Over a million private pour-flush lavatories and several thousand public toilet complexes have been constructed. The sites chosen include stations, markets, hospitals and residential areas. Due to the density of the informal settlements, which prevents households from having a private sanitary solution, residents are motivated to manage the public block. The sites are maintained day and night and costs are recovered through user charges. Although the project has had success in the public areas, it has been less successful in the low-income settlements due to the charges being too costly.

2.2.3 Summary

Co-production arrangements have gained popularity since the arrangements depend on both community involvement, to take the lead in intra-community action, and larger public actors, mainly to deal with the problem of waste disposal outside the community. They also often find solutions without external funding since co-producing sanitation solutions with representative community organisations can bring down costs, help generate more revenue, and make shared and community solutions work where a toilet for each household is too expensive (Satterthwaite et al., 2015).

2.3 Policy and Regulation in South Africa

This section of the document provides an overview of the regulatory and legislative provisions relevant to sanitation provision in South Africa. This includes the overarching policy and regulation as well as those pertaining to the water services and housing sectors.

2.3.1 Overarching policy and regulation

Constitution of the Republic of South Africa

Schedule 4B of the Constitution of the Republic of South Africa Act, No. 108 of 1996, as amended, provides that water and sanitation services limited to potable water supply systems and domestic waste water and sewage disposal systems are a local government function and are an area of concurrent national and provincial legislative authority.

Municipal Structures Act, No. 117 of 1998

Section 84(1) of the Municipal Structures Act provides for the division of powers and functions between district and local municipalities. In terms of this section of the Act, potable water supply systems and domestic waste water and sewage disposal systems are identified as being the functions of a district municipality.

Section 84 of the Municipal Structures Act provides that the minister of local government may, by notice in the Government Gazette, and after consultation with the cabinet member responsible for the functional area in question, and after consulting the member of executive council (MEC) for local government in the province and, if applicable, subject to national legislation, authorise a local

municipality to undertake the water and sanitation function. The Act provides that the minister must in this notice regulate the legal, practical and other consequences of the authorisation, which may include the transfer of staff and the transfer of assets, liabilities, rights and obligations, and administrative and other records.

Municipal Systems Act, No. 32 of 2000

The Municipal Systems Act clearly indicates that municipalities must strive to ensure that municipal services are provided to local communities in a financially sustainable manner (including the maintenance, repair and replacement of physical assets) (sections 1 and 4 of the Act). This has to be achieved through prudent, economic, efficient and effective use of available resources within each municipality's financial and administrative capacity. The Act also encourages regular review of its practice to achieve improvement in service quality (section 73 of the Act).

Municipal Financial Management Act, No. 56 of 2003

The Municipal Finance Management Act (MFMA) was developed to ensure sound and sustainable management of the financial affairs of municipalities and other institutions in the local sphere of government. The MFMA legislates all financial related activities that municipalities conduct including items such as budgeting and supply chain management.

2.3.2 Sanitation regulation and policy

The purpose of the National Water Act (No. 36 of 1998) is to ensure that South Africa's water resources are used, managed, and controlled in a manner which considers:

- Meeting the basic human needs of current and future generations.
- Promoting equitable access to water.
- Redressing the results of past racial and gender discrimination.
- Promoting the efficient, sustainable and beneficial use of water in the public interest.
- Facilitating social and economic development.

Water Services Act, No. 108 of 1997

The Water Services Act (No. 108 of 1997) legislates the municipal function of providing water and sanitation services and provides for, among others:

- The rights of access to basic water supply and sanitation needs.
- The setting of national standards and tariffs.
- A regulatory framework for water service institutions and water service intermediaries.
- Financial assistance to water service institutions.

The Water Services Act also provides for the establishment of water services institutions including water services authorities. The Act defines a water services authority (WSA) as any municipality that is responsible for ensuring access to water services.

SFWS (2003)

The SFWS sets out the national framework for water services and addresses the full spectrum of water supply and sanitation services. The purpose of the SFWS is to develop a vision for the water sector, provide the framework by which the vision can be realised, and provide the targets for achieving the vision.

The SFWS notes that providing services to people living on land without permission from the owner is a challenge to WSAs. The framework notes the WSA should provide an interim basic water and sanitation solution in accordance with a progressive plan that addresses land tenure and basic services. The SFWS also states that the bucket system is an unsuitable and inappropriate level of service. Communities and municipalities must agree on the appropriate system to be used to replace buckets. Ventilated improved pit (VIP) latrines are deemed to be an acceptable level of service as it will not be feasible to provide all consumers with waterborne sanitation due to water availability and infrastructure funding constraints. The SFWS also highlights that the challenges of providing free basic sanitation can be linked to the items detailed in Table 4.

Table 4: Challenges of providing a free basic service

Challenge	Description
Infrastructure provision	The key challenge is providing the sanitation facility (with all the required supporting infrastructure) to poor households. The type of facility provided will depend on settlement conditions, but the framework notes that in urban areas waterborne sanitation should typically be regarded as a basic level of service for the purpose of the free basic sanitation policy. On-site technical solutions are noted as an acceptable level of service in low density rural areas. The WSA must determine the appropriate technology in intermediate areas to select a technology that is financially viable and sustainable. On-site sanitation solutions are expected to be the most likely choice in these instances.
Health and hygiene	The promotion of health and hygiene must be correctly managed, co-ordinated and funded to ensure that free basic sanitation becomes a reality.
Operation and maintenance cost	The operating and maintenance costs of sanitation facility to a poor household must either be covered by the local government Equitable Share and/or through cross-subsidisation within the WSA consumer base.

White paper on basic household sanitation (2001)

The white paper on basic household sanitation was developed to articulate government policies on sanitation and to provide the basis for the formulation of local, provincial and national sanitation improvement strategies aimed at addressing the backlog. The minimum acceptable basic level of sanitation as defined in the policy as:

- Appropriate health and hygiene awareness and behaviour.
- A system for disposing human excreta, household waste water and refuse, which is acceptable to the users, safe, hygienic and easily accessible and which does not have an unacceptable impact on the environment.
- A toilet facility for each household.

The policy document also states that community members should be involved in the decision-making process. Community participation is seen to be a key requirement in the conceptualisation, selection, planning, design, implementation, operation and maintenance of all projects. Health and hygiene awareness and education should also be included as an integral part of sanitation programmes.

Free Basic Sanitation Implementation Strategy (2009)

The Free Basic Sanitation Implementation Strategy was developed to ensure that all residents are provided with a functioning basic sanitation facility by 2014. This was a revision of the target provided in the SFWS. The 2014 target is in line with a Department of Housing target to ensure that all South Africans have access to a house by 2014. The strategy defines a basic sanitation service as providing a basic sanitation facility that is easily accessible to a household, the sustainable operation of a facility – including the safe removal of human waste and waste water from the premises where this is appropriate and necessary – and the communication of good sanitation, hygiene and related practices.

The strategy adopts the principle that the national guidelines should be implanted with local choice and that community participation is a key foundation for the sustainable choice of sanitation technologies. The strategy also highlights that a municipality may have to accommodate informal settlements and provide temporary services to households in these settlements until permanent services can be provided. In the case of illegal settlements, where households have no right over the land and with the opposition of the landowner, temporary services should be provided at no charge. It is possible to provide a solution that may be permanent, but this will not be easy to apply.

National Sanitation Policy (2016)

A draft National Sanitation Policy was published for comment during the research period (DWS, 2016). The final policy[6] was published as this project concluded and is therefore not reflected in the report, but mention is made where policy recommendations made as a result of this research align or conflict with the National Sanitation Policy. The National Sanitation Policy defines the minimum acceptable basic level of sanitation to be the lowest costing and appropriate system that considers resource constraints, and is acceptable and affordable to end users. The policy further adds that such systems must be safe, hygienic and easily accessible and do not impact on the environment. The policy also includes the policy position that the minimum acceptable standard of basic sanitation service levels is one toilet and handwashing facility for each household. Position 23 of the policy states that capital expenditure must be integrated with the associated operation and maintenance requirements and expenditures.

Regarding informal settlements, the policy notes the challenges with providing sanitation in dense informal settlements and those located on private land. It proposes the following policy positions (Position 1):

- Interim basic sanitation services should be provided in temporary informal settlements. These sanitation services should be appropriate, affordable, and practical in accordance with a progressive plan that addresses both land tenure and basic services.
- Where permanence of informal settlement is recognised, local government is obligated to ensure access to basic sanitation services.
- Sanitation services should be provided in informal settlements in consultation and with participation of the community.
- Community engagement process and mechanisms should be utilised to promote in situ upgrades of sanitation.
- Community-based planning, implementation and operation and maintenance of interim informal settlements sanitation solutions is encouraged.
- Labour-intensive provision of sanitation in informal settlements is encouraged.

6 Available at: https://www.dwa.gov.za/Documents/sanitation/Approved%20Sanitation%20Policy%20Positions%20December%202016.pdf. Accessed 07 February 2017.

Community-based operation and maintenance of interim sanitation solutions in informal settlements is encouraged. The position on emergency sanitation stated that these interventions should be limited to short term, temporary interventions, with temporary being defined by the minister.

2.3.3 Housing regulation and policy

Housing Act (1997)

The Housing Act and the Housing Amendment Bill (2010) set out the mandate of government regarding the human settlements function in line with its constitutional obligations. The Act provides for priority to be given to the poor in terms of settlement development and provides for the Housing Code, and issuing of guidelines and suggestions on how to implement and fulfil government's human settlements responsibilities. The Housing Amendment Bill (2010) specifically provides for the graded devolution of the housing function to municipalities and compels national and provincial government to build capacity for assigning the housing function to local government. This has further entrenched the roles and responsibilities provided for in the original Act, which have since been set out in the National Housing Code.

Breaking New Ground Policy (BNG) (2004)

As a result of a review of the national housing programme from 1994–2004, the BNG policy marked a significant shift in housing policy, setting out a new vision for housing as reconceptualised in the form of sustainable human settlements. Sustainable human settlements are defined as: "well-managed entities in which economic growth and social development are in balance with the carrying capacity of the natural systems on which they depend for their existence and result in sustainable development, wealth creation, poverty alleviation and equity". It is further described as a safe and a secure environment with adequate access to economic opportunities, a mix of safe and secure housing and tenure types, reliable and affordable basic services, educational, entertainment and cultural activities and health, welfare and police services (DHS, 2004:11). The document further sets out a new plan and approach to human settlements creation, which expanded the scope of the work of the then housing department considerably and sought to better integrate and coordinate work with other government departments and entities. Thereafter, the department changed its name to the DHS in line with the new settlements paradigm.

The BNG policy introduced a more flexible approach to housing interventions, introducing a wide range of housing programmes to enable more appropriate and diverse settlement interventions, including the Upgrading Informal Settlements Programme (UISP). The BNG policy comprised key elements in relation to the need for changes to the financial arrangements surrounding the housing subsidy at the time. These covered the need to:

- Restructure the subsidy instrument.
- Adjust beneficiary contributions and criteria.
- Enhance beneficiary criteria.
- Enhance funding flows.
- Address fraud, corruption and maladministration.

The amendments were intended to meet the growing demand for and responsiveness to the need for housing.

Housing Code (2009)

The policy prescripts of BNG are encapsulated in the Housing Code (DHS, 2009), which describes the multiple national housing programmes. The four main categories of housing programmes are: financial, incremental, social/rental, and rural. The two dominant housing programmes are the Integrated Residential Development Programme (IRDP) and the UISP. The Housing Code provides the minimum national technical norms and standards for the creation of serviced residential stands and houses. The Housing Code requires residential structures to have external and internal privacy, adequate protection against the elements, potable water, adequate sanitary facilities and a domestic energy supply.

Each house has a minimum size of 40 m^2 and must be designed on the basis of:

- Two bedrooms.
- A separate bathroom with a toilet, shower and handbasin.
- A combined living area and kitchen with washbasin.
- A ready board electrical installation where electricity supply in the township is available.

2.4 Institutional Aspects Relevant to South Africa

The institutional aspect of the study assessed the role of the key public bodies associated with providing sanitation [Department of Water and Sanitation (DWS), municipalities, DHS, etc.)] as well as civil society and specifically the role of CBOs. It must be noted that DWS is undergoing a process of institutional reform and has a new department that is tasked with providing sanitation services. Given the critical part played by municipalities, the study investigated the challenges that these organisations face that limit their ability to carry out their mandate.

2.4.1 Key role players

Table 5 indicates the different institutions involved in providing sanitation to households:

Table 5: Institutional role players[7]

Institution	Role
DWS	The DWS is the national custodian of water resources and has the responsibility for the oversight of water services. The DWS also has the responsibility to ensure that water is allocated equitably and used beneficially in the public interesting while promoting environmental values.
WSA	WSAs are the local authorities legally designated to be responsible for the potable water supply and sanitation function. WSAs could be metros, districts or local municipalities. WSAs are responsible for planning, ensuring access to, and regulating the provision of water services in their area of jurisdiction. The responsibility of the WSAs includes the financing of capital and operational activities.

7 Sourced from, “Multi-Sectoral Survey” as commissioned by DPME and prepared by PDG in 2014.

Institution	Role
Water Services Provider (WSP)	WSPs are responsible for the actual provision of water services to consumers or to another water services institution. The majority of WSPs are municipalities, which are also WSAs. WSPs may also include another municipality, community-based providers, water boards and private operators that have been appointed under lease or concession type contracts.
Department of Cooperative Governance (DCoG)	DCoG regulates and oversees the activities of local government, and other national government departments and provincial governments play an important role in supporting the water sector. Regulates municipal service partnerships. Integrated development in which water service development planning is involved. Allocates funds to local government. Regulates municipal affairs and intervenes.
DHS	Ensures that housing policies recognise the right of WSAs to establish service level policies that are affordable and sustainable to the municipality; promote water use efficiency; and are aligned to local government policies regarding water and sanitation.
Private sector providers	Private providers include larger scale lease or concession type contracts. However, there are other types of providers that provide a range of other services to municipalities, which do not qualify as full WSP contracts. These include operating contracts and management contracts.
South African Local Government Association (SALGA)	SALGA is an autonomous association of South African municipalities that aims to represent, promote and protect the interests of local government while also developing capacity with municipalities.
Civil society organisations	Civil society organisations include non-governmental organisations (NGOs) and social movements. The role of NGOs will be determined by the communities in which they work with the principle of making the community the client applicable to all NGOs (DWAF, 1994).

2.4.2 Areas of responsibility

The SFWS assigns the responsibility for ensuring access to water and sanitation to designated WSAs. There was a further shift in responsibility when the sanitation function was moved from DWS to DHS in 2009. Currently, the WSAs are responsible for providing basic water and sanitation to citizens.

At a national level, the responsibility for sanitation has shifted over the past 15 years. The capital funding instrument was moved from the Department of Water Affairs (DWA) in 2001 to the Department of Provincial and Local Government (now DCoG) with the DWA maintaining a regulatory and policy function as well as establishing a local government support programme. The whole sanitation programme was moved from DWA to DHS in 2009. This programme has subsequently moved back to the DWS. This fragmentation and lack of a single national body has resulted in challenges regarding the coordination, effective regulation, maintenance of norms and standards, and monitoring the performance of sanitation delivery (DWA & DHS, 2012).

Housing

In terms of the constitution, housing is an area of concurrent national and provincial legislative responsibility. The national DHS is the custodian of all housing programmes, which are implemented by provincial housing departments. In addition, the accreditation process, as laid out in the Housing Act and Housing Code allows for the accreditation of municipalities to undertake the administration of certain housing functions. Municipalities that could prove their capacity to plan, implement and maintain projects and programmes would be accredited at various levels to undertake certain functions on behalf of provincial government.

The Policy Framework and Guidelines for the Accreditation of Municipalities, approved in 2005 and revised in 2012, sets out the criteria and process for accreditation. Level 1 accreditation is restricted to delegation of beneficiary management, budget planning and administration and priority programme management and administration, while Level 2 accreditation sees the delegation of full programme management and administration to the municipality. Level 3 was the highest degree of accreditation which included management of funds. However, the revised national Framework for Assignment and Accreditation (2012) replaced Level 3 accreditation with full assignment of the housing function by the MEC in terms of the Municipal Systems Act (RSA, 2000). With assignment, the Human Settlements Development Grant (HSDG) funds would pass directly from the national department to the municipality without first going to the provincial department. This would give municipalities full control over the sanitation services provided through the national housing programmes.

2.4.3 Housing programmes and interim solutions

The DHS has introduced the UISP, which relates to the provision of grants to a municipality to carry out the in situ upgrading of informal settlements in a structured manner (DHS, 2009). The programme allows for the installation of interim and permanent municipal engineering services with an allowance for projects to be co-funded by other grant funding sources [such as MIG and Urban Settlements Development Grant (USDG)].

IRDP

The IRDP supports the development of integrated settlements in well-located areas and provides for the acquisition of land, servicing of stands for a variety of land uses, housing typologies, and income levels. The programme can be undertaken in one step or in two phases, beginning with serviced stands and following with the construction of top structures. Projects undertaken within the IRDP must be a part of the approved integrated development plan (IDP), with the province or the municipality assuming the role of the developer. However, in the latter case, the MEC is still responsible for project approval and the distribution of funds (DHS, 2009).

UISP

The UISP focuses on providing secure tenure, access to basic services, social and economic amenities and options for housing development to people residing in informal settlements. The programme is aimed at the in situ upgrading of informal settlements, although it does allow for residents to be relocated and settled elsewhere. Municipalities will once again fulfil the role of the developer and apply for funding to the provincial departments (DHS, 2009).

Housing assistance in emergency circumstances

This programme has been developed to temporarily accommodate households in the process of upgrading informal settlements while services are being installed or formal houses are being built. This programme also caters for providing temporary housing relief to households who have suffered natural

or man-made disasters. Funding is focused on the absolute essentials and projects under this programme should be planned as the first phase towards a permanent housing solution (DHS, 2009).

2.4.4 Intergovernmental planning

Improper integration of intergovernmental relations has resulted in the duplication of effort and poor delivery of services. This can be highlighted by examples of a single household being provided with two or three houses, RDP homes being constructed without any toilet facilities, and waterborne sanitation not being connected to the sewer network (DHS, 2012).

Some municipalities have advised that they are only able to provide services to informal settlements once these areas have been formalised. It has been noted that this is in contradiction to the Constitution of South Africa and the Water Services Act (DHS, 2012).

2.4.5 Capacity

A lack of project management skills at a municipal level affects project delivery and results in funding losses (DHS, 2012). Waste water treatment works are also understaffed and poorly maintained, which is a challenge for municipalities mandated to provide a safe and effective waste water service to residents (SALGA, 2009).

The Municipal Services Strategic Assessment (MuSSA) consists of 16 criteria to assess the vulnerability of municipalities. MuSSA has appraised that approximately 80% off WSAs have a very high vulnerability classification based on the criteria that focus on assessing the financial and technical capacity of municipalities. The lack of technical capacity at a municipal level has affected the ability of water services institutions to plan, implement and manage infrastructure negatively (DWA & DHS, 2012).

The Green Drop programme seeks to identify and develop the core competencies required to improve the level of waste water management in South Africa. The 2011 Green Drop has highlighted that only 40 of the 826 treatment works assessed were able to achieve a Green Drop Status with 317 plants requiring urgent attention while a further 143 plants have a high risk of failure. This further highlights the challenge of the sector (DWA & DHS, 2012).

2.4.6 The role of civil society organisations

The traditional role of NGOs was seen to be community empowerment, advocacy and the promotion of innovation, but NGOs have since moved towards being implementing agents with capacity in rural areas. The role of the NGO has evolved as the scale of the water and sanitation challenge has escalated to combine service delivery with advocacy through engagement with government (Water and Sanitation Program, 2002).

Civil society organisations that are involved in providing sanitation services are presented in Table 6.

Table 6: Civil society organisations

Institution	Description
Mvula Trust	The Mvula Trust is South Africa's largest water and sanitation NGO, which was established in 1993. This organisation is involved in the implementation and support of water and sanitation services in rural and peri-urban areas in South Africa (Socio-Economic Rights Institute of South Africa, 2011).

Institution	Description
Abahlahli baseMjondolo	The Abahlahli baseMjondolo (Shack Dwellers) Movement began in Durban in 2005. The organisation has developed a sustained voice for shack dwellers (Abahlahli baseMjondolo, 2006).
Tsogang	Tsogang is an NGO that was founded in 1994. It has worked in the entire value chain of sanitation including infrastructure, quality management, operation and maintenance and customer care. Tsogang has also worked with the National and Provincial Sanitation Task Teams to develop policies (Tsogang, n.d.).
SDI South African Alliance	The South African Alliance of community organisations and support NGOs affiliated to the Shack/Slum Dwellers International (SDI) has pioneered people-centred development initiatives for the poor since 1991 (SDI South African Alliance, 2015).

2.5 Financial Aspects Applicable to South Africa

2.5.1 Fiscal framework

The fiscal framework deals with all local government expenditure and the means which this expenditure should be funded. The key principle is that local government is funded sufficiently by a combination of funds raised by the municipality itself and transfers from the national fiscus for the municipality to provide an effective service to all citizens in a sustainable manner (DCoG, 2012).

The Local Government Fiscal Framework (LGFF) is designed to fund local government, and not only the transfers from national government. The structure of the LGFF is complex and multi-dimensional and, while there have been various structures of the LGFF in the past, the Financial and Fiscal Commission (FFC) has proposed the framework depicted in Figure 9 (FFC, 2012).

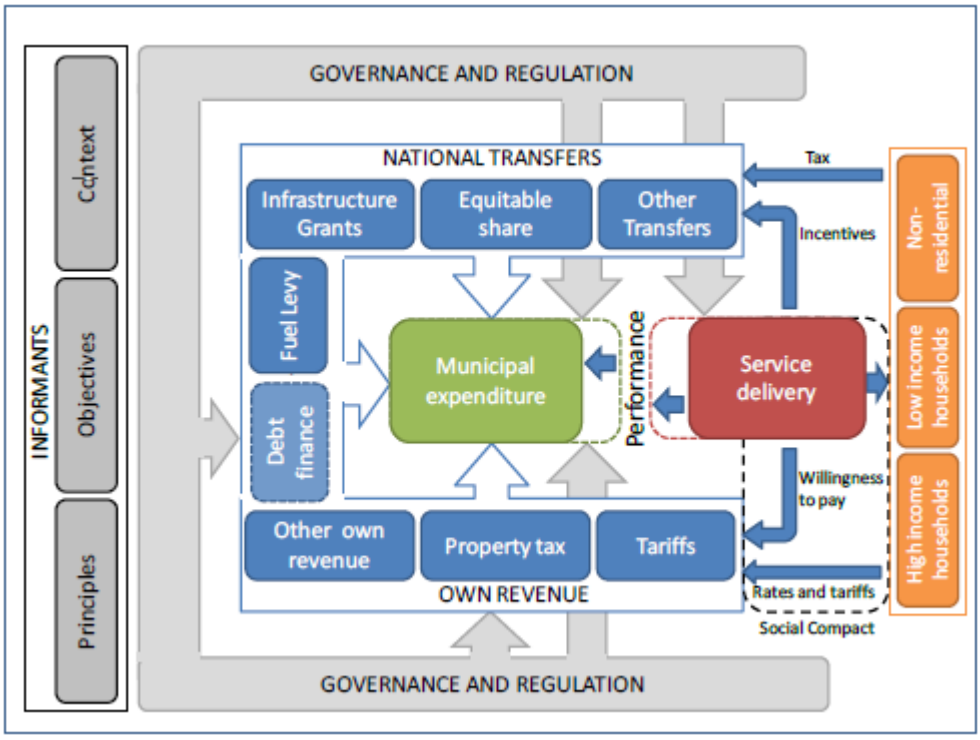

Figure 9: Structure of the LGFF

The LGFF highlights that, while national transfers form a part of a municipality's revenue stream, there are other revenue-raising options available. These other funding options can be categorised into municipal revenue and external funding and are detailed in Table 7 (Standard Bank, Rand Water & National Business Institute, 2006).

Table 7: Municipal funding options

Category	Explanation
Intergovernmental transfers	These are national government grants that are made available to municipalities, and which are allocated annually in the Division of Revenue Act.
Municipal revenue	Funding generated by a municipality through tariffs, user charges, development charges and rates.
External funding	External funding sources can be in the form of debt raised in long-term loans, issuing of bonds or PPPs.

Intergovernmental transfers may be separated into capital, operational grants and capacity-building transfers. Capital grant funding is used for financing infrastructure that is used to develop an acceptable sanitation facility, while operational grants are used to provide a basic sanitation service as highlighted in the SFWS. Capacity-building transfers are applicable to the development of skilled staff to ensure that municipalities are able to deliver on their mandate.

The next section of the document highlights the capital, operational and capacity-building transfers, as well as the borrowing options available to fund the provision and operation of sanitation infrastructure.

2.5.2 Transfers from the national fiscus – summary

A summary of transfers from the national fiscus – for operating activity and capital investment for water and sanitation – is given in Table 8.

Table 8: Transfers made to municipalities that can be used for water services (2016/17 allocations)

	Amount (R billion)	Description	Application to water services	Benefiting municipality	Type
Transfers covering general expenditure					
Equitable share formula	47.1	Share of national total revenue	Used to cover WS operating costs for poor	All	Unconditional, formula based
Regional services council (RSC) levies replacement	4.6	Residual from when districts raised own levy	Not strictly for WS but may be used	Districts	Unconditional, formula based
Fuel levy sharing	11.2	Share of national fuel levy	Not strictly for WS but may be used	Metros	Unconditional, based on fuel sales

	Amount (R billion)	Description	Application to water services	Benefiting municipality	Type
Infrastructure grants					
Housing subsidies	18.3	Provincial grant allocated to projects and specific beneficiary households	Housing subsidies can be used for internal WS infrastructure	Locals	Allocated to provinces by formula; province decides on projects
MIG	14.9	Primary infrastructure grant but excludes electricity	Covers WS other than for LMs in DW category	Non-metros	Formula based, conditional
USDG	10.8	Infrastructure, land and social services. Emphasis on informal settlements	Covers WS	Metros	Formula based, conditional
Regional bulk infrastructure grant (RBIG)	5.3	For bulk water and sanitation infrastructure, part to municipalities, part 'in kind'	WS only	Districts and locals (in kind)	DWS decision
Water services infrastructure grant (WSIG)	3.2	For water services to 27 priority districts	WS only	Specific municipalities (21 DW districts and local municipalities in six districts)	Formula based, conditional
Bucket eradication grant	0.4	Used to replace buckets with higher service sanitation (phasing out)		Specific municipalities (mainly LW)	DWS decision
Capacity-building grants		Various small transfers	Minimal use for WS capacity	All	Various

2.5.3 Operating transfers

Equitable Share

The local government Equitable Share is an unconditional formula-based transfer. While municipalities have full discretion over how it is spent, the intention of national government is for it to be used to subsidise the delivery of free basic services to poor households. The formula has a basic services component aimed at providing free basic water, sanitation, electricity and refuse removal services to households with a monthly household income of less than R2300 per month. The basic services allocation provides a subsidy of R313.76 per month for the 2015/16 financial year for basic services to each poor household (National Treasury, 2015). However, municipalities with a low revenue base are heavily reliant on the Equitable Share as their primary source of operation revenue which, in this case, reduces the amount that can be allocated to services for poor households (DWA & DHS, 2012). In these poorer municipalities, this results in funding allocated to the sanitation service being lower than that required.

RSC/Joint Services Board (JSB) Levies Replacement Grant

District municipalities receive the RSC/JSB Levies Replacement Grant, which is a component of the Equitable Share transfer. Only the districts that are WSAs could potentially use this for water and sanitation, but it is unlikely to be used for this purpose.

Fuel levy

Metros receive a share of the national fuel levy. But, while this strengthens their revenue base, it is unlikely to be used for sanitation.

2.5.4 Capital grants

HSDG

The purpose of the HSDG is to provide funding to create sustainable and integrated human settlements through various programmes. It has an allocation of R18.2 billion for the 2015/16 financial year. The national housing programmes funded by this grant includes the IRDP and the UISP (National Treasury, 2015).

The HSDG can be used to construct housing top structures, serviced sites (including sanitation), and basic social and economic facilities (DWA & DHS, 2012). However, in metros the HSDG is used only for top structure, which is the house excluding services. Outside of metros, local municipalities are heavily reliant on HSDG for internal services, and even look to the DHS to contribute to bulk infrastructure projects to unlock human settlement developments.

MIG

The MIG is aimed at providing all South Africans with sustainable access to a basic level of service by providing grant finance targeted at covering the capital cost of basic infrastructure for the poor. The grant is administered by the DCoG and has an allocation of R15 billion in the 2015/16 financial year (National Treasury, 2015).

MIG is a consolidated capital grant that funds the provision of infrastructure to basic services, roads and social infrastructure for poor households in non-metropolitan municipalities. The consolidated grant provides municipalities with control of infrastructure projects within their jurisdiction. As such, this grant can be spent on other basic services that municipalities may deem to be of a higher priority than the provision of a basic sanitation service (DWA & DHS, 2012).

USDG

The purpose of the USDG is to supplement the capital revenue of metropolitan municipalities to support the national human settlements development programme by focusing on poor households (National Treasury, 2015). The grant has a total allocation of R10.5 billion in the 2015/16 financial year. The grant conditions require municipalities to prioritise the eradication of bucket sanitation backlogs and to spend a minimum of 50% on the grant funds to upgrade informal settlements.

RBIG

The RBIG is a capital grant managed by the DWS, which is intended for regional bulk water and waste water infrastructure. It is an indirect grant in that it is not paid out to municipalities. Water boards need to apply for it. The DWS assesses the applications and makes decisions on how the project should be implemented. There is a view that the projects selected are not really regional in nature and that, with the funding of smaller scale infrastructure, there are overlaps with what the WSIG and MIG do (Palmer et al., 2017). The RBIG is not allocated to metros.

WSIG

WSIG is a capital grant for water supply and sanitation infrastructure allocated to the 21 district councils that are WSAs, and the local municipalities that are WSAs in the other six district councils, which are considered by government to be priority districts. It is primarily a direct grant (paid out to municipalities), distributed by formula with an emphasis on poverty and service backlogs.

Bucket Eradication Programme Grant

The Bucket Eradication Programme Grant was previously termed the Indirect Human Settlements Development Grant and was directed to provinces under the DHS. However, the grant name has changed, and it has been handed to DWS to administer.

The grant is a special two-year allocation that aims to provide funding to eradicate bucket sanitation and provide a basic level of sanitation in formal areas. This grant is not projected beyond the 2015/16 financial year. The allocation for the 2015/16 financial year is R975 million (National Treasury, 2015).

2.5.5 Capacity-building transfers

Municipal Human Settlements Capacity Grant

This grant was introduced in 2014/15 to fund the capacity in six metropolitan municipalities that were granted Level 2 accreditation to administer certain national housing programmes. However, the grant will now be extended to the eight metros to build capacity and subsidise the operational costs of administering human settlements programmes. The allocation to municipalities for the 2015/16 financial year was R100 million.

Infrastructure Skills Development Grant

The purpose of this grant is to develop infrastructure delivery management capacity within municipalities by recruiting unemployed graduates in municipalities to be trained as per the requirements of the relevant statutory councils within the built environment. The direct allocation to municipalities is R124 million for the 2015/16 financial year (National Treasury, 2015).

Expanded Public Works Programme (EPWP) Integrated Grants for Municipalities

This grant funds the use of labour-intensive methods in delivering municipal infrastructure and services.

The grant is allocated based on past performance and is weighted to provide larger allocations to poor rural municipalities. The allocation to municipalities for the 2015/16 financial year was R588 million.

2.5.6 External funding sources

Municipalities are able to raise capital for infrastructure by raising long-term debt. This can be in the form of loans taken from a financial institution for a specific project or the municipality as a whole. The Development Bank of South Africa has traditionally provided loan funding for infrastructure as have private banks. Cape Town, Johannesburg and eThekwini have also issued their own bonds. Private sector funding is also available in PPPs. These relationships require the private partner to provide a portion or all the capital for particular assets for a period of 15 years.

The funding of social infrastructure is typically funded from national transfers as residents who receive a basic service cannot usually afford to pay for it. However, a municipality may be able to use a portion of commercial debt to install infrastructure that could then be subsidised by the consumers who are able to afford the higher payment. Alternatively, a municipality may be able to find efficiencies within the system by employing an appropriate partner for a PPP. This may lead to savings that can be directed to social infrastructure such as sanitation services for poor consumers.

2.5.7 The funding gap

Funding of capital expenditure

Figure 10 presents the water sector (including water resources infrastructure and infrastructure for non-potable water supply) capital finance gap specific to the different institutional groups within the sector (Development Bank of Southern Africa, 2012). The capital required was determined by considering the provision of new infrastructure and the rehabilitation of existing infrastructure. Figure 10highlights that local government can be expected to experience the largest funding gap of all institutions at R17 billion per annum. This relates specifically to water supply and sanitation.

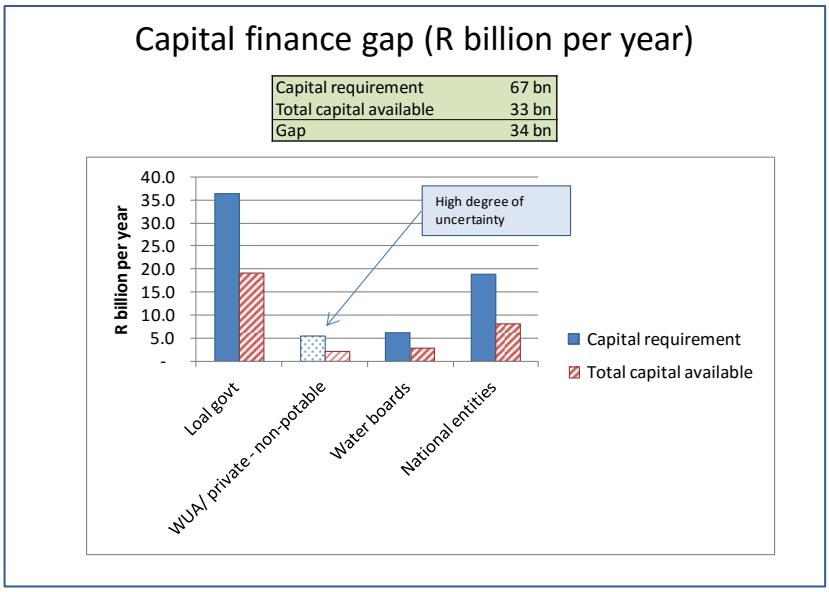

Figure 10: Capital finance availability by institutional grouping[8]

8 Taken from the "Water Sector Investment Framework: Phase 2 Report" commissioned by the Development Bank of Southern Africa and prepared by PDG on 11 June 2012

Funding of operational expenditure

Table 9 highlights the funding surplus and deficit for each of the different municipal categories as modelled for 2010/11.

Table 9: Operating account balance for WSA subcategory[9]

Rm	A	B1	Local WSA	District WSA
Sanitation				
Expenditure	3764	1524	1100	**1597**
Revenue	4569	1949	915	**1256**
Equitable share	966	711	141	**277**
Tariffs	3603	1238	774	**979**
Balance	805	425	−185	**−341**
% surplus	**21%**	**28%**	**−17%**	**−21%**

The analysis represents an idealised situation where operating expenditure is sufficient to provide an adequate level of services, and tariffs are set and collected properly. The results indicate the ability of metros and B1 municipalities to generate a surplus on their operating accounts. Local WSA and district WSA municipalities are seen to be generating a deficit on the operating account. However, the analysis undertaken for the MIIF indicates that there is a large gap in the availability of capital for municipal services across all categories of municipality.

The DPME have estimated that R45 billion is required to provide basic sanitation services to unserved households with a further R31 billion being required to refurbish and upgrade existing facilities (South African Human Rights Commission, 2014).

2.5.8 Key considerations

The MIG and the USDG can be used for funding water, sanitation, solid waste and roads infrastructure, including bulk and connector infrastructure. The USDG can be used for funding internal infrastructure including the top structure of housing. It has been noted that municipalities do not prioritise sanitation as there is no dedicated budget for sanitation at a municipal level (SAHRC, 2014). The Western Cape study (Annexure B) found that it is unlikely that significant amounts of grant funding could be redirected to sanitation, or that the absolute quantum of grant allocations would increase.

The separation of the bucket eradication programme from the HSDG indirect allocation has resulted in the DHS being responsible for the funding of the top structures of housing while the required services have to be funded by the municipalities. The acquisition of land is also a contentious issue as municipalities often have to use their own land and funding for acquiring land.

Far too few municipalities have accurate data on the actual cost to provide sanitation services to residents. The actual cost of providing the service should include the costs associated with water provision, sewer maintenance, waste treatment, user education and support, vehicle maintenance and service extension. The impact of the funding shortfalls between the municipal revenue raised and the

9 Taken from the "Municipal Infrastructure Investment Framework (MIIF): Water Services Report" commissioned by the Department of Cooperative Governance and Traditional Affairs and the Development Bank of South Africa and prepared by PDG on 4 October 2010.

expenditure required to provide a sustainable sanitation service is highlighted by the large number of failing waste water treatment works nationally (SALGA, 2009).

Generally, dry sanitation solutions do not usually provide a direct income stream for municipalities. Thus, municipalities will need to consider other revenue streams to fund on-site sanitation services. Therefore, municipalities will either need to receive considerable additional funding in terms of the Equitable Share allocation or reprioritise the existing allocation that is received. In contrast to the MIIF analysis results reported above, it must be noted that many municipalities have stated that current funding allocation of the Equitable Share is well below the actual costs of providing the actual service (SALGA, 2009).

2.6 Technology

A basic sanitation facility is the infrastructure necessary to provide a facility that is safe, reliable, private, is protected from the weather, is ventilated, keeps smells to the minimum, is easy to keep clean, minimises the risk of the spread of sanitation-related diseases by facilitating the appropriate control of disease carrying flies and pests, and enables safe and appropriate treatment and/or removal of human waste and waste water in an environmentally sound manner. There are several technology options available on the market in South Africa. This section of the document describes the available technology and highlights the key advantages and disadvantages associated with each technology.

Whatever the choice of technology selected, the construction phase should be done in a manner that promotes both community ownership and job creation along with delivering a high-quality facility that people will be proud of and that will function effectively to the design standards over the facilities expected useful life. The local authority is responsible for ensuring user education and the proper use and care for the facility. The general rule is that the greater the household responsibility for operations and maintenance, the more extensive the user education programme is that should be implemented. However, this has a lower municipal tariff and municipal operations and maintenance cost (DWAF, n.d).

It was noted at the Sanitation Indaba in Durban that the full range of technical options for providing adequate basic sanitation is still not widely known, nor are the characteristics of the different options well understood (DWS, 2015). In particular, there is little appreciation of the long-term financial, environmental and institutional implications of operating and maintaining the various sanitation systems. As a result, in many cases communities and local governments are choosing technical options that are unaffordable and/or unsustainable in the long term.

In recent years, there has been a flurry of new and innovative sanitation solutions entering the market. The technologies, mostly offering off-the-grid solutions, use a variety of new processes such as drying, desiccation, dehydrating, composting and digestion. In addition, many new cutting-edge processes are also entering the market in the form of pyrolysis, carbonization, bulking, pressurizing, etc. (DWS, 2015). Existing technical options available to municipalities when considering rolling out sanitation services to urban areas have been well documented and include:

- Chemical toilets.
- Portable flush toilets, typically referred to by their product name – porta potties – get much media attention.
- VIP latrines.
- Urine diversion toilets.
- Septic tanks.
- Communal toilet blocks.
- Sewered sanitation with various options for the type of internal sewerage.

These options are discussed briefly below along with the associated advantages and disadvantages of each technology.

2.6.1 Chemical toilets

There are various types of chemical toilet, but these are generally standalone units that use a water-diluted chemical in a receptacle below the toilet seat to render excreta harmless and odourless (DWAF, n.d). The toilets are typically housed in plastic privy (or equivalent material), which can be transported and positioned easily on levelled ground. They are typically located in a public place along a road and are shared between a number of households. One toilet to five households is considered to be a desired ratio, but this is not necessarily achieved.

Chemical toilets are not recommended for large scale use as they do not meet the safety and environmental criteria for a basic level of service. They are only suitable for short-term temporary solutions as they are expensive and require regular emptying (DWAF, n.d). Chemical toilets have a relatively high capital cost and require regular emptying. Therefore, these units need to be installed in areas that are accessible by a vacuum tanker. Also, the chemicals used in these toilets can have a negative impact on the performance of a waste water treatment works (CSIR, 2000).

2.6.2 Porta potty system

A portable flush toilet, which is typically referred to as a porta potty, is an on-site improved portable plastic container that uses a water flushing mechanism to deliver waste matter into a holding tank not visible to users. It consists of a standard toilet seat and two tanks, one containing clean water for flushing and the other for housing waste and black water. The second of these tanks is a sealed container containing chemicals to deodorize the waste. This sealed tank can be removed from the unit for disposal. The small size of these tanks means they must be collected on a regular basis by a sanitation service provider, the waste disposed of appropriately, and a clean tank inserted in its place (Barbeton, Townsend & Carter, 2016). The waste-holding tanks can be emptied by contractors at a central point and returned to the household. Widely applied in Cape Town, these toilets have mixed reviews. Stewart (2014) assessed their acceptance in Jim Se Bos informal settlement where they were found to be acceptable. However, activists from other settlements have used them in protests against unacceptable sanitation.

2.6.3 Low-flush toilets connected to sewers

While the use of low flushing volumes has proved successful for on-site systems (Still, 2013), research is still being undertaken to assess options for reducing flush volumes for in-house toilets connected to sewers. For the purpose of this study, it is assumed to be feasible in the future and is included as an innovative technology.

2.6.4 Sewered waterborne sanitation

Sewered waterborne sanitation is widely used in South Africa and is the level of service that most South Africans aspire to. These systems are designed to allow waste from the toilet to be flushed into the sewer network and removed to a central waste water treatment facility.

There are several advantages to sewered waterborne sanitation solutions. The system is hygienic, and free of flies and odours if operated correctly. The toilet can be placed indoors, can be used in high-density areas (CSIR, 2000) and is most convenient to users. There are various options for treating the waste water both in centralised and, less widely applied, decentralised treatment works (SALGA, 2009).

However, waterborne sanitation is an expensive solution. It requires relatively high capital per connection to a household, as well as additional costs to the household and maintenance of the sewer network (DWAF, n.d). Waterborne sewage systems can also contribute to inadequate water resources, shortage of water and sanitation infrastructure, as well as the shortage of skills to operate and maintain the current water and sanitation network. This is may be an expensive solution in terms of capital and operating costs (SALGA, 2009).

It is often not possible to install conventional waterborne sewerage in informal settlements due to the manner in which the units are laid out as well as unfavourable ground conditions (Taing, Armitage, Ashipala, & Speigel, 2013). The system requires large amounts of water to operate effectively. Flushing usually requires from six to ten litres of water per flush, but this can be reduced with low-flush plans designed to operate with three litres per flush (CSIR, 2000).

2.6.5 Septic tanks

Septic tanks are a waterborne sanitation option where the treatment of waste water occurs on-plot. They are widely used by formal rural households and farming areas that have a reliable water supply. The system is designed to allow waste to discharge from the toilet into a septic tank that acts as a settling chamber for solids. The solids settle to the bottom of the chamber and undergoes biological digestion. The liquid passes out of the tank and into a soak-away (DWAF, n.d).

The primary advantage of a septic tank system is that it provides users with a high level of service and convenience. The septic tank solution can further be a possible upgrade to the low-flow on-site system. Septic tanks are hygienic, and free of flies and odours if operated correctly. This type of solution provides a high level of user convenience as the toilet can be placed indoors and all household liquid can be disposed of via this system (CSIR, 2000).

A drawback to the septic tank solution, however, is that digested sludge accumulates in the system and must be removed via a tanker approximately every three years and disposed at an appropriate sludge treatment facility. The septic tank system also requires a reliable household water connection and is applicable only in areas of low settlement density.

The use of septic tank systems can be seen to be problematic. It was considered to be an expensive solution due to the high operating costs for municipalities. In certain instances, municipalities are trying to implement new technologies because the septic tanks have failed, but a shortage of funds makes this difficult (DHS, 2012). Typically, when servicing informal settlements, designing for limited space solutions is critical. A disadvantage of a septic tank is the space required for the tank as well the additional requirements to accommodate an evapotranspiration system.

2.6.6 Alternative sewer configurations

Simplified sewerage

Simplified sewerage systems are based on the relaxation of conventional gravity sewerage design standards as engineers felt that the design standards of the traditional systems were conservative and resulted in costs being higher than required. Usually the pipes are of a smaller diameter and laid at a shallow depth than the conventional system. Community involvement in management and maintenance issues are the preferred option in areas where such systems are installed (CSIR, 2000).

Settled sewerage

Settled sewerage is reliant on having a septic tank on the property with the effluent from the tank transported to a waste water treatment works in relatively small diameter pipes laid at a shallow depth

without the necessity to have gravity flow. Thus, the septic tank – sometimes called an interceptor tank – reduces the load to the treatment plant via the sewer network. However, it has to be desludged on a regular basis (Taing et al., 2013).

The settled sewerage system requires a relatively large capital outlay if new tanks have to be constructed. Also, interceptor tanks have to be inspected and cleaned on a regular basis. However, the system is suitable for use in high-density areas and provides users with a high level of convenience (CSIR, 2000).

Vacuum sewerage

Vacuum sewerage systems use differential air pressure to transport sewerage in pipes to the main sewer network. Vacuum sewerage pipe networks can be laid at even shallower gradients than gravity-driven systems. The use of differential air pressure results in a reduced risk of blockages and ensures that the system is not limited by topographical constraints.

Vacuum sewerage systems are alternatives to conventional systems in areas where there is a short supply of potable water as flushing velocities in sewers are hard to attain and maintain. Differential air pressure can propel sewerage at an acceptable velocity, which is largely independent of the volume of water used (Little, 2004).

2.6.7 Alternative waste water treatment works configuration

The option of having more decentralised waste water treatment systems with treatment works located within neighbourhoods (typically serving 100–10 000 people), rather than having waste water transported in collector sewers to a central treatment works, has been mooted in the literature. This has been included in this study as an innovative option although the work done by PDG et al. (2016) indicates that this is a more expensive option for metros in South Africa.

2.6.8 VIP latrines

VIP latrines are designed to allow waste to drop into the pit where the organic material decomposes and the excess liquid percolates into the surrounding soil. Natural airflow removes odours from the pit to the atmosphere by a vent pipe. VIP latrines have been widely used in rural and peri-urban areas of South Africa and are found to be robust (DWAF, n.d).

Advantages of the VIP latrine include being fairly easy to build and requiring relatively low capital costs per unit depending on the location and choice of materials. Operating costs are only incurred when the pit has to be emptied, which can be expected to be an average of eight years depending on the number of users. Thus, this solution is one of the cheapest forms of sanitation that can maintain an acceptable health standard.

It is possible to design the VIP so that when the pit is full, the household will dig another pit and transfer the structure to the new pit while covering the old pit (DWAF, n.d). However, if the stand is small, there may be insufficient space to allow continual relocation of the toilet and arrangements for the emptying of the pit will need to be made (CSIR, 2000).

A shortcoming of the VIP latrine, however, is that it cannot be located inside a house and must be located in such a manner as to prevent the ingress of storm water or contamination of local groundwater used for drinking (DWAF, n.d). Thus, there can be problems with a high water table, which will require minor adaptions to the pit.

Failures of VIP latrines can usually be attributed to inadequate user education, poor design and construction, or inadequate emptying service. Residents often complain that regular monitoring of VIP projects are not conducted and that units are not built according to acceptable norms and standards (DHS, 2012).

Many VIP latrines are badly built and are not used at all while the inability to empty full pits have driven towards the inadequate bucket system or open defecation. The failure to empty pits can be attributed to municipalities not knowing how to deal with the full pits and consumers not viewing this as their responsibility (SALGA, 2009). Poor attention to the effective operation and maintenance of VIP latrines have resulted in pits being filled with no plans in place to empty the units. The use of corrugated iron top structures in windy areas and the failure of households to maintain the facilities, especially toilets doors, are also challenges that municipalities face when selecting VIP latrines as an appropriate sanitation solution.

2.6.9 Urine diversion toilets

Urine diversion toilets are a type of dry on-plot composting or desiccating system that separates the urine and waste through a specially adapted pedestal. The waste is deposited into the chamber below the pedestal, which can be used as compost by adding other dry absorbent organic material. Urine can also be collected and used as fertilizer or drained into a soak pit where it will seep into the soil. The solids are safe to be removed within six to 18 months.

In certain instances, these toilets can have lower capital and operating costs than VIP latrines. They contribute to an absence of flies and odours if used correctly (CSIR, 2000). A particular benefit of urine diversion toilets compared to VIP latrines is that these units can be installed in high-density settlements with small erven. Furthermore, these toilets do not require a pit and can thus be installed inside a house. The urine can also be collected and reused as an agricultural fertilizer (CSIR, 2000). However, control of moisture content is vital for the proper operation of compositing or desiccating toilets, which is a drawback. Users are also often responsible for disposing the compost and emptying containers when required. Thus, user education programmes are important to ensure that these toilets are operated correctly, and that the sludge is disposed in a safe and hygienic manner (DWAF, n.d). Residents often find urine diversion toilets difficult to use, hard work to clean and that they do not function properly.

2.6.10 Communal ablution blocks

A community ablution block (CAB) is a shared sanitation facility, which is connected to a local sewer where effluent can be discharged. The units have separate areas for male and female users. Each area has toilets, washbasins and showers with provision made for a wash stand and a storeroom (Roma, Buckley, Jefferson, & Jeffrey, 2010).

An advantage of communal blocks is the ability to provide other services with a toilet unit. eThekwini Municipality has undertaken to provide shared facilities containing ablution, showering and laundry facilities for communities living in informal settlements. This model has been applied in other municipalities such as Buffalo City but requires good management and monitoring. Using caretakers and supplying consumables have reduced vandalism (DWS, 2015).

However, CABs do have disadvantages as well. Taing et al. (2013) asserted that shared toilets are often mismanaged because neither the local authorities nor the users accept responsibility for these facilities. It was also recommended that municipalities provide communal blocks with janitorial services along with an operation and maintenance service.

The then Department of Water Affairs and Forestry (DWAF) advised that communal toilets are not recommended for large scale use as they do not meet the safety and environmental criteria for a basic

level of service. The department advised that the communal block system should only be considered for temporary use where a high level of cleanliness and maintenance can be assured (DWAF, n.d).

2.6.11 Low-flow on-site system

Low-flow on-site systems allow users to flush the toilet pan or pedestal with a low volume of water (usually one or two litres) after use (DWAF, n.d). The waste from the pan is discharged into a digester positioned underneath the toilet. The solid portion of the digester content decomposes within the digester while the liquid component is displaced to a soak-away with each use of the toilet. The digester must be desludged after a period of one to three years.

A primary advantage of low-flow on-site systems is that they usually have a relatively low operating cost and are relatively easy to install. This system is internationally accepted and is well suited to areas where only small volumes of water is available. The system can also be sized to accept domestic waste water if required (DWAF, n.d). Despite the advantages, the challenges associated with this technology option can be related to a lack of user education, poor design (inadequate tank sizes specifically) and poor construction. Water has to be carried to the flush tank and this has proved to be problematic in a few installations (DWAF, n.d).

2.6.12 Key technology challenges

Of concern is that these technology options are not considered in a holistic manner resulting in solutions that are neither financially sustainable nor sustainable from an operational and maintenance viewpoint. It has also been noted that the failure to provide an effective refuse collection system in high-density residential areas will result in citizens using toilets to dispose of refuse material, which will impact on the performance of the sanitation facility and cause the pits to fill in a more rapid manner than expected (CSIR, 2000).

All forms of on-site sanitation will result in an accumulation of sludge in the system, which will have to be removed after a period of time. The stability of the sludge will determine the manner in which the sludge can be handled and disposed. Sludge that has not stabilized must be treated and disposed without causing harm to the environment or health. Sludge that has been stabilized and is devoid of pathogens can be used as compost (CSIR, 2000).

CABs require an increase in lighting and personal security measures around the facility as well as regular cleaning and maintenance procedures to be used effectively. Other studies have highlighted similar findings, which have noted that the convenience of use, cleanliness and privacy to be key drivers of a successful intervention (Diallo et al., 2007 and Duncker et al., 2006 as quoted in Roma et al., 2010).

The DHS ministerial sanitation task team conducted a review of sanitation in South Africa. They have advised that the following sanitation solutions are not considered to be appropriate (DHS, 2012):

- Unimproved pit toilets.
- Bucket toilets.
- Chemical toilets.
- Communal toilets.

The general consensus is that unimproved pit latrines and the bucket systems are considered to be an inadequate level of service. However, there are several municipalities that provide communal blocks and chemical toilets as sanitation solutions in certain areas. There is sufficient evidence that these need to be considered as an appropriate temporary sanitation option.

The link between communities and technology

Technologies are devices that provide citizens with a service. The willingness and skill of a community in managing its environment and promoting healthy living is important and must be considered when implementing a technology. A technology will not be accepted nor used if the community's will is lacking (DHS, 2012).

DHS has advised that community participation is a principle of the national housing programme. The community participation dialogue should include issues such as (SAHRC, 2014):

- Layout of the development.
- Service standards.
- Housing typologies.

However, this community participation process may not always be followed as asserted by the South African Human Rights Commission (2014). Sutherland et al. (2013) have noted that the main reason that considerations of communities cannot be addressed is the urgency to provide sanitation solutions to informal settlements.

Technology is expected to be a key driver to address the sanitation delivery challenges, but all solutions need to be focused on the end user. It was suggested that people should be presented with the technology that offers convenience and safety while also being involved in the decision-making process (DWS, 2015). It is imperative that representatives of communities in which sanitation projects are being undertaken are consulted and fully informed of the technology that is being consider in order to promote the sustainability of sanitation solutions. These representatives should then inform other residents of their options and choice (DWAF, n.d)

Key social issues that have been identified include (DWA & DHS, 2012):

- Low community acceptance of toilet quality.
- Inadequate involvement of communities in the planning and implementation.
- Low affordability of households to pay for maintenance.
- Inadequate health awareness and user education.

2.7 Key Findings of the Literature Review

The literature review highlighted that 66% of the world's population is expected to live in urban areas by 2050 (United Nations, 2014). South Africa has also experienced an increase in urbanisation, as two-thirds of the population now reside in urban areas compared to the 52% in 1990 (Urban Landmark, 2013). The increase in the urban population has contributed to the growth of informal settlements, which has increased pressure on government to meet the increasing demand of adequate housing, water and sanitation in these areas. International literature has further shown that co-production arrangements have gained popularity in addressing these pressures, largely due to community buy-in and cost reduction benefits.

South Africa has made progress in providing sanitation services and has a strong sanitation regulation, policy and fiscal framework. However, 1.4 million households do not have access to a sanitation service. Further to this, 3.8 million households in formal areas are provided with a substandard service. Significantly, 60% of the urban sanitation backlog is located within the eight metropolitan municipalities.

The importance of providing adequate sanitation services cannot be underestimated as this has an impact from a health, well-being and economic point of view. Sanitation is also considered an index of equality with history showing that toilets often trigger conflicts (Penner, 2010). South Africa has experienced an increase in service delivery protests, which include sanitation issues, between 2008

and 2012. Communities living in informal settlements often complain that there is a lack of public participation and access to information.

There are several key role players involved in providing sanitation services in South Africa. These include the DWS, local government and the private sector. Importantly, the DHS also has a key role to play as many South Africans access sanitation services via the national housing programme. The lack of technical capacity at municipalities is a challenge, which has impacted negatively on the delivery and sustainability of services.

There are a number of capital grants that can be used to provide sanitation infrastructure. The Equitable Share is an unconditional operating allocation that can be used for operating costs. Previous studies have revealed that there is a capital funding gap, but the problem with covering operating costs with revenue raised locally and supplemented by transfers is less severe: specifically, metropolitan municipalities and secondary cities should be able to generate surpluses on their operating accounts. The unconditional nature of the USDG, MIG and Equitable Share could result in the funding being directed towards providing services other than sanitation.

There are several sanitation technology options available in South Africa with different advantages and disadvantages. There is a view that sanitation solutions other than sewered waterborne sanitation may be considered inferior (Pan, Armitage & Van Ryneveld, 2013). The technology options are sometimes not considered in a holistic manner, which can result in municipalities employing solutions that are neither financially sustainable nor sustainable from an operation and maintenance view.

Based on the findings of the literature review, the study focused on sanitation provision in urban informal settlements, where the problem is most severe. Given the high priority of sanitation in informal settlements currently, there is a need to better understand the issues in these situations.

3 STAKEHOLDER ENGAGEMENT

The literature review phase of the project raised several critical challenges and constraints pertaining to urban sanitation both internationally and in South Africa. To refine these insights, the project team engaged with officials and communities from four metropolitan municipalities to capture the local perspective and understand what municipal officials as well as communities view as key considerations in providing sanitation services in urban informal areas.

The four selected metros for these engagements were seen to be representative of areas that faced the greatest urban sanitation challenges:

- eThekwini Metropolitan Municipality.
- Ekurhuleni Metropolitan Municipality.
- City of Johannesburg.
- City of Tshwane.

Engagements with organisations that represent the interests of communities were also conducted to understand the view of communities. The full list of municipal engagements is presented in Annexure A.

It should be noted that the challenges in these municipalities are not only urban. Sanitation in peri-urban areas has also been challenging, particularly on tribal land. However, based on the definition of urban for this study, the peri-urban circumstances were not included in this study.

3.1 Institutional Challenges and Constraints

Municipalities have broadly responded to the urban sanitation challenge in one of two ways. The first is to provide houses with waterborne sanitation while the second response is to provide temporary sanitation solutions in informal settlements. Formal housing can be provided in the form of greenfield development or in situ upgrading of informal settlements. Providing formal housing is the mandate of the municipal department of human settlements, while providing the bulk sewer and temporary sanitation solutions are the responsibility of the water and sanitation unit within the municipality.

3.1.1 Coordination within the municipality

The municipal department of human settlements, and as the water and sanitation units in the municipality each have a role to play when addressing the challenges associated with urban sanitation. Their roles appear to be complimentary, thus engagement between these departments is important when providing sanitation. However, the coordination and communication between these two departments are problematic at times.

Most of the metros engaged take their guidance from the Human Settlements Directorate regarding providing formal housing. eThekwini has noted that there have been problems experienced with the coordination between the bulk sewer network capital programme and the housing programme. This could be especially problematic in areas where houses are being developed and there is no bulk sewer capacity. eThekwini Water and Sanitation (EWS) has recently formed an interdepartmental housing and water and sanitation committee to ensure that the communication, planning and delivery of projects between the departments are better co-ordinated.

Additional challenges arise when the human settlements department change their plans without any communication to the water and sanitation units. Tshwane has noted that housing programmes are included in the master plans and are used for planning purposes. However, changes to these housing programmes are not communicated, resulting in the sanitation department being required to address this challenge at a later stage.

3.1.2 Political agendas

Interviewees noted that changes are made to housing plans for political reasons. While there may be good reasons for the political decisions, the resultant changes in the housing programme often have a negative impact on the ability of departments to deliver services effectively. This is because they have to adjust their capital programmes accordingly. Further difficulties are experienced if changes are made but not communicated to other stakeholders.

Political cycles also hamper municipal institutions tasked with addressing the urban sanitation challenge. Often key decision makers are appointed on five-year contracts that align to local government elections. Changes to these appointments can result in changes to housing and sanitation programmes, which cause further delays that can affect the productivity of departments negatively.

Politics also affects the budgeting and tariff setting process. Technical departments express the view that budgets are created in an opaque manner that is not based on anything tangible. The result is that there is insufficient funding allocated to preventative maintenance, which in turn results in higher expenditure on reactive maintenance. In addition to this, water and sanitation departments are limited regarding the tariffs that can be charged due to political reasons. The result is that they cannot generate the revenue required and thus need to cut expenditure to below what they believe is necessary.

3.1.3 The role of development facilitators in providing sanitation

The role of development facilitators such as NGOs was envisaged to be determined by the communities in which they work with the principle of making the community the client (DWAF, 1994). During the municipal engagement phase of the study, municipal officials were requested to provide information on NGOs that regularly engage when providing sanitation to communities. However, officials at Tshwane, Ekurhuleni and the CoJ were not familiar with organisations that represent the interests of communities. This suggests that there is very little engagement between the organisation tasked with providing sanitation and development facilitators.

The study completed for the Western Cape Government (Annexure B) found that the discrepancy between the state and civil society's perspective on the meaning of participation is a challenge. The state conflates participation with consultation (sharing ready-made plans, or merely disseminating information), while civil society organisations advocate for processes grounded in co-production where communities have real decision-making power.

The study conducted in the Western Cape found that communities are sceptical of a state that does not deliver on their promises. It was also found that, given that the various physical and social conditions in informal settlements will determine the sanitation solution to be provided, planning and provision should take place at a disaggregated level.

3.1.4 The challenge in the way in which municipalities work

The previous section suggested that there is an opportunity for development facilitators to be more involved in providing sanitation. However, the way municipalities work makes this difficult.

The Community Organisation Resource Centre (CORC) identifies the traditional way of doing things in municipalities as the biggest institutional barriers they face, with professionals within the institution being unwilling to sign off innovative ways of doing things, such as reblocking informal settlements. Another institutional challenge the municipality faces is finding service providers who are prepared to work with communities in a way communities want to work. Communities want to focus on developing small clusters at a time with widespread engagement. Contractors, however, do not find this as profitable as

building on a larger scale. This complicates the procurement and finance processes on the part of municipalities.

3.1.5 The role of private sector providers

The private sector is considered to be a vast resource that can contribute to sanitation in a variety of areas including (DWAF, 1994):

- Capital investment.
- Operation and maintenance.
- Training and capacity building.
- Organisation development.
- Financing and commercial services.

Private providers include larger scale lease or concession type contracts for bulk water or waste water services. Other types of providers include operating contracts, and management contracts. Private providers can also act as implementing agents for housing or upgrading projects.

3.1.6 Restructuring within the water and sanitation unit

Metropolitan municipalities are currently in a state of flux based on their organisational structure. Three of the four municipalities included in the study have recently completed organisational reviews in a bid to align themselves better to address challenges that are faced.

The City of Tshwane undertook an organisational restructuring process in 2015. The restructuring process resulted in the regionalisation of operations. There are currently seven operational regions within the municipality, with each region being responsible for operating and maintaining the sewer network within their jurisdiction.

The water and sanitation unit at Ekurhuleni Metropolitan Municipality has also recently undertaken an organisational review and has begun restructuring and creating new positions. This included developing an informal settlements unit. However, the organisation has experienced difficulties in filling the vacant positions.

EWS has also recently undergone an organisational restructuring process. This process focused on senior management positions and ensuring alignment of units within the water and sanitation unit.

3.1.7 Summary of stakeholder engagement

The departments of human settlements and water services (water and sanitation) are key role players in addressing the urban sanitation service provision within a municipality. The department of human settlements is tasked with delivering formal housing. The water and sanitation unit provides the bulk and collector sewer network, as well as provides temporary sanitation solutions. Coordination between these two departments can be problematic at times, which soften delay projects or increases project costs.

Political intervention in the decision-making process can result in changes to plans that are in place, as well as have budget implications. This can result in projects being delayed as plans are being reviewed and insufficient funding being allocated to preventative maintenance programmes.

It was originally envisaged that development facilitators could play a really important role in providing sanitation in urban and rural areas. However, the role of development facilitators appears to be limited at this point in time. Nevertheless, these development facilitators do appear to have an important role

to play as residents appear to be sceptical of municipalities in certain situations. There also appears to be a reluctance on the part of the municipalities to change the way they work. The disjuncture appears in the manner that communities want to be engaged and involved in the development of solutions while municipalities want to focus on technocratic project management processes with technology selected exclusively by engineers. There is thus a space for development facilitators to act as intermediaries.

Institutionally, metropolitan municipalities appear to be in a state of flux, as the City of Tshwane, Ekurhuleni and eThekwini have been through recent organisational restructuring processes. Whether this will improve sanitation provision in informal settlements remains to be seen.

3.2 Funding Challenges and Constraints

This section of the report deals with the funding arrangements associated with urban sanitation in the metropolitan municipalities that have been engaged during this phase of the study.

3.2.1 Funding allocations within the municipality

Capital finance

To cover their capital expenditure, metropolitan municipalities receive grant funding from the National Treasury, raise long-term debt finance, apply reserves and, in some cases, use development charges (more typically for new developments). Typically, grant funding should be used to finance social infrastructure, which includes providing sanitation to settlements for low-income households, including informal settlement upgrades. Other funding mechanisms should be used to finance economic infrastructure.

The funding that the sanitation unit within a municipality is able to raise is constrained as debt finance is raised centrally and then allocated to each of the service units (water, sanitation, electricity, solid waste etc.). The result is that the sanitation department may not receive the funding that officials within the department feel is adequate based on their requirements.

Operating expenditure

The metros fund their operational activity through tariffs raised from consumers supplemented by transfers from the national fiscus in the form of the local government Equitable Share. The process of setting tariffs requires the sanitation unit to prepare annual tariff proposals for submission to the central treasury office within the municipality. This office is then responsible for approving the tariffs. It was stated that this can be a highly politicised decision and the approved increase in the tariff is not necessarily equivalent to the increase in the cost associated with providing the service.

Figure 11 indicates that in 2011, sanitation charges for the metros in South Africa were approximately consistent with countries of comparable socio-economic conditions. However, South African sanitation tariffs are significantly lower than relatively more economically developed countries. The average sanitation charge used in South African metropolitan municipalities was 32% lower than the median for the International Water Association's (2012) international data set of 44 countries (Palmer, forthcoming).

The tariff rates should be considered in conjunction with water tariffs, as was done by Palmer et al. (forthcoming), which found comparable results. While raising water tariffs to all consumers is difficult because of the impact on lower income household costs, there is potential for increasing water and sanitation tariffs for higher income households in South African metros.

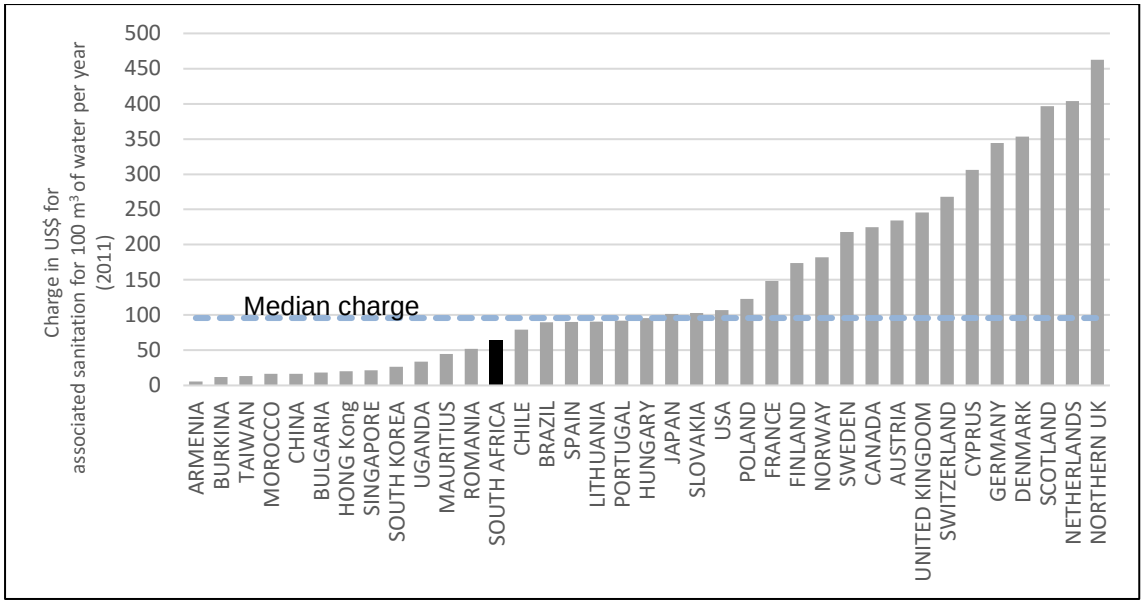

Figure 11: International comparison of charges for water and sanitation in urban areas

Source: International Water Association, 2012; Palmer et al., forthcoming; *SA metro data used as representative of urban South Africa (authors' calculations).*

Centralised decision-making

Transfers are directed to the municipality as a whole with centralised decisions on the allocation to water and sanitation. Transfers are calculated by National Treasury based on a formula. For these transfers, primarily Equitable Share and USDG, it is thus possible to calculate the amount theoretically intended for water and sanitation by National Treasury. According to the interviewees, the water and sanitation units typically receive lower allocations than indicated by the National Treasury formulae.

It is important to note that the Equitable Share is an unconditional operating transfer that can be allocated at the discretion of the municipality. This principle also holds true for the USDG (capital grant). Therefore, municipalities are entitled to reprioritise the funds received from these grants based on their contextual requirements. However, officials argue that the grant funding received from the central office is inadequate for the social component of the services provided by the sanitation unit.

Another example mentioned where municipal treasury decisions do not favour water and sanitation delivery is that of the CoJ, where no Equitable Share funding is allocated to Johannesburg Water. Thus, Johannesburg Water is required to generate all revenue from tariff income. The cost of providing the service to low-income households is cross-subsidised by higher income households and non-residential consumers.

3.2.2 Adequacy of funding

eThekwini has identified that R2.2 billion in capital expenditure is required to eradicate the water and sanitation backlog over an eight-year period. However, only R50 million of grant funding is made available annually. In addition to this, approximately R300 million is required annually to renew assets. Thus, the capital funding received through capital grants is insufficient to reduce the backlogs and renew infrastructure.

Johannesburg Water has also noted that their current capital expenditure programme is approximately R790 million annually, but this is decreasing in real terms. The result of the decrease is that

Johannesburg Water is replacing less than 1% of their assets annually. This will create a backlog of renewal that will have to be undertaken by future generations.

Ekurhuleni has estimated that between R150 million and R200 million a year is required to provide for additional waste water capacity in the system. However, only R50 million year can currently be allocated. Most of this allocation goes to upgrading existing infrastructure. The result is a shortage in available capacity in the network.

The lack of available capital funding poses a significant risk to the sustainability of the business, as infrastructure that is not renewed timeously will lead to an increase in infrastructure failing. This will also lead to significantly higher expenditure in future when the infrastructure will need to be replaced.

However, it has been suggested that the issue is the distribution of resources within the municipality and not the adequacy of funds. The Social Justice Coalition (SJC) started working with the International Budget Partnership in 2014, looking into budget transparency. They have reviewed Cape Town's budget from 2007 to 2014/15 and have argued that the city has produced an unfair budget. They argue that the city has allocated only R22 million from the capital budget for providing flush toilets in informal settlements in 2015 in comparison to R106 million for a parking garage for the city's finance directorate. They also argue that the direct capital allocation to informal settlements has remained the same since 2007, while he overall capital allocation to waste and sanitation has grown significantly.

3.2.3 Can the funding gap be expected to increase?

Capital finance gap

Capital expenditure needs to be balanced between funding for social services (sanitation to poor communities included) funding for new economic infrastructure, and for renewing existing infrastructure.

eThekwini is responsible for a large waste water infrastructure system. This includes large parts of the system that are reaching the end of their useful lives. This can result in increased spillages and a decrease in the quality of service that is provided.

The City of Tshwane has also advised that parts of the bulk sewer network were installed more than 50 years ago. The result is that there is an extensive pipe replacement programme in place. In addition, the network has almost reached its design capacity. This is attributed to densification and sprawl. The city is required to install additional bulk network capacity. The nett result is that even if adequate allocations were made for social infrastructure, the delay in renewal of infrastructure means that the funding gap increases.

3.2.4 Getting more money is not enough to solve the problem

While it can be seen that the funding allocated to sanitation is insufficient, simply increasing the funding allocation to municipalities, raising more debt or increasing tariffs will not solve the sanitation challenge that municipalities face. There are many other factors that impede sanitation delivery, even if sufficient funding is available.

Regulatory issues

Ekurhuleni has noted that despite additional funding being required, the city faces challenges in obtaining water use licences. This is currently impeding their ability to deliver on the capital expenditure problem. Water use licences require the annual monitoring of groundwater at each waste water treatment works. The cost of this at each waste water treatment works is approximately R1 million. eThekwini is responsible for 27 waste water treatment works. Water use licences are also proving

difficult to acquire, which results in municipalities struggling to deliver on capital expenditure. The implementation of national policies has funding implications and it is important for policymakers to note these costs prior to policy implementation.

Procurement issues

Ekurhuleni has identified procurement as a challenge in delivering CABs in informal settlements. The municipality had budgeted for the delivery of a number of units but was inhibited by a lack of capacity in the procurement process to meet their targets. The procurement process can take up to a year from project initiation to appointment of a service provider. A less substantial example of procurement problems was given by eThekwini in getting toilet paper for CABs. Procurement constraints have resulted in an increase in toilet and sewer blockages as residents have used newspapers as a replacement.

The skills challenge

One of the constraints to improving sanitation provision is the lack of capacity, particularly technically qualified engineers, technologists and technicians. For example, eThekwini has noted that skilled staff required in the sanitation sector are scarce. The municipality currently has an ageing technical staff complement, and faces a challenge that many skilled staff have retired or will retire soon. Ekurhuleni has also mentioned that it can be difficult to appoint engineers with the relevant experience to perform particular functions. EWS has introduced an internal mentoring and coaching programme to ensure the transfer of skills and development of younger staff.

It was also noted by eThekwini that accessing additional funding should be possible for metropolitan municipalities given their large revenue base. However, there is a barrier within the municipality in spending the money on capital projects. The capital expenditure programme comprises several projects. The delivery of capital projects is constrained by the number of employees who have the capacity to fulfil the different roles required within a project team. Limiting factors include time to check project documentation, project management and administrative requirements.

The DWS has also implemented Regulation 17 from the Water Services Act (No. 108 of 1997) with respect to process controller regulation. The classification of waste water treatment works will determine the number and skill sets required for each waste water treatment works. The intention for this is to ensure that each plant is operated and maintained by sufficiently skilled staff. There are some cases where the regulation requires additional staff, which is a challenge given the perceived skills shortage. Funding is also a challenge.

3.2.5 Summary of funding challenges and constraints

Municipalities engaged with during this phase of the study have stated that funding allocated to the water and sanitation units is insufficient to meet their capital and operating requirements. Part of this can be attributed to the allocation of national transfers by the treasury office within each municipality.

The water and sanitation units face constraints in raising their own funding through debt finance, which puts increasing demand on transfers. Part of the inability to raise debt finance is caused by lack of revenue to cover the cost of capital as tariffs approved by the municipality are usually much lower than those sought by the water and sanitation units due to political reasons. The result is that the water and sanitation units have to adjust expenditure downwards to ensure a balanced budget. The funding gap is expected to increase as more money is required to renew ageing infrastructure.

The SJC has stated that the issue may be more around the way municipalities prioritise their expenditure items rather than the total quantum of funding received. In addition, merely acquiring more

funding will not solve the problem as procurement and regulatory requirements, such as water use licences, also impact on municipalities' ability to effectively spend funding that has been allocated.

The municipality notes that additional staff would also be required if funding was increased to deliver on projects. However, there is currently a skills shortage with many senior personnel in municipalities being close to retirement or having already retired. This further impacts service delivery as younger staff struggle to acquire the skills to successfully fulfil their roles within the municipal environment.

3.3 Assessment of Technology Options

Municipalities can make choices both on the technology option and on the level of service provided.

3.3.1 Service level

The term service level is used to refer to the number of households served by a technology option. Municipalities make policy decisions related to whether a chemical toilet, for example, will serve one household or many. The Western Cape study (Annexure B) highlighted that sanitation could be provided at a household, shared or communal scale depending on policy decisions and site constraints.

Table 10: Service level

Service Level	No. of households per toilet	Comments
Household	1	• In dense settlements (>100 units per ha), many households do not have sufficient space. • Privacy between family members may be compromised due to space constraints. • Provides best level of security, especially at night. • Promotes sense of ownership.
Shared	5	• Requires some degree of self-organisation to establish which households are sharing. • Requires good collaboration between houses sharing. • May be maintained by households or maintenance staff. • Can be installed as individual units close to the home, or as a dedicated toilet within a central facility. • Promotes ownership.
Communal	5 (usually provided in blocks of 6 to 10 toilets)	• High user numbers will lead to an increased maintenance burden. • The number of households (or more specifically people) per toilet should be kept to a minimum. • Communal toilets require full-time/on-site maintenance in the form of a caretaker. • The caretaker should be employed from the immediate community. • Requires space for communal facility.

The technology choices that follow can thus be configured into one of the three service levels detailed in Table 10. The exception being CABs, which would naturally be a communal facility.

3.3.2 Technology options

There are several technology options available to municipalities in South Africa. While waterborne sanitation is usually provided in formalised urban areas, providing temporary or interim sanitation in informal settlements is usually a mix of technical solutions. This section of the document describes the available technology and highlights advantages and disadvantages associated with each. The existing technical options that municipal officials consider when rolling out sanitation services to urban areas include:

- Chemical toilets, including porta potties, which get much media attention.
- VIP latrines.
- Communal toilet blocks.
- Sewered sanitation with various options for the type of internal sewerage.

Table 11 details the sanitation technologies that each municipality involved in the study considers for installation in informal settlements.

Table 11: Temporary sanitation technology preferences

Municipality	Technology	Comment
Ekurhuleni Metropolitan Municipality	• CABs. • Chemical toilets.	Chemical toilets are the preferred sanitation technology option.
eThekwini Metropolitan Municipality	• CABs. • Chemical toilets.	The municipality have experimented with several technology solutions. These are presented in Annexure A.
CoJ	• VIP latrines. • CABs. • Chemical toilets.	VIP latrines are the preferred level of service in informal settlements, but chemical toilets are preferred in areas where VIP latrines cannot be installed.
City of Tshwane	• Chemical toilets.	Waterborne sanitation is the only other option provided.

The City of Tshwane has decided that only chemical toilets or waterborne sanitation will be installed in urban areas. Chemical toilets are provided as an interim solution before full waterborne sanitation is provided. The city has been approached to participate in new technology studies but have declined as the risk of failure is high.

The CoJ has indicated a preference to install VIP latrines in informal settlements. However, geotechnical conditions and space often do not allow for VIP latrines to be installed in all areas. Chemical toilets are used where VIP latrines cannot be used.

Chemical toilets

There are various types of chemical toilets, but these are generally standalone units that use a water-diluted chemical in a receptacle below the toilet seat to render excreta harmless and odourless (DWAF, n.d). For the purposes of the study, toilets that use this type of technology are categorised as chemical toilets (with a fibreglass housing) or porta potties. Chemical toilets are not recommended for large scale use as they do not meet the safety and environmental criteria for a basic level of service. These units are only suitable for short-term temporary solutions as they are expensive and require regular emptying (DWAF, n.d).

The porta potty is a portable toilet that allows for natural seating, water flushing and storing of waste water in a high capacity waste-holding tank that can be detached, replaced and emptied remotely. The porta potty can be used within the homes of residents and thereby reduces the risk of leaving their houses late at night. The waste-holding tanks can be emptied by contractors at a central point and returned to the household (Stewart, 2014).

As noted in Table 11, chemical toilets are used to varying degrees in all four of the metros surveyed, with this being the primary sanitation technology that Ekurhuleni provides to informal settlements. They are also widely applied by the City of Cape Town where their unpopularity has received considerable press coverage. The argument for them as a technology is that they can be easily installed in informal settlements. Service providers are usually appointed to supply and service these toilets.

Ekurhuleni provides ventilated chemical toilets that include a handwashing facility. The current ratio of chemical toilets to residents is high in the municipality, in some cases as high as one chemical toilet for up to 15 or 20 people. The current municipal policy aims to reduce this to 1:10 and consideration is being given to reduce this further to 1:5.

The CoJ also provides chemical toilets for a group of households rather than one toilet being allocated to each household, similarly to what is done at Ekurhuleni. These are only provided in areas where VIP latrines cannot be installed.

eThekwini only uses chemical toilets in exceptional circumstances as the operational and maintenance costs associated with these units are relatively high.

Sewered waterborne sanitation

Waterborne sanitation is widely used in South Africa and is the level of service that most South Africans aspire to. The CoJ asserts that providing waterborne sanitation to all households would possibly be the best solution for residents. This is because other technologies such as chemical toilets and VIP latrines are sometimes more challenging to operate and maintain than waterborne sanitation. However, formalising informal settlements is a challenge and the planning associated with this has to be improved.

CABs

A CAB is a shared sanitation facility connected to a local sewer where effluent can be discharged. The units are installed with separate areas for male and female users. Each area has toilets, washbasins and showers with provision also made for a wash stand and a storeroom (Roma, Buckley, Jefferson, & Jeffrey, 2010).

eThekwini has undertaken to provide CABs in informal settlements (Figure 12 and Figure 13). The city delivers, on average, 200 CABs annually. The municipality has stated that these units are constructed at a target of one set for every 70 dwelling units and are established within 200 metres of households. The municipality has noted comments from residents about the distance required to walk to a facility, particularly at night.

eThekwini has noted that providing CABs is a good interim service when an informal settlement is not on the short- or medium-term housing list. The city has appointed janitors from the local community served by each toilet block to ensure that facilities function well. Ekurhuleni has appointed agents to maintain the toilet blocks, which assists in ensuring that facilities are operating well. These agents are private individuals who live in the community within which the facility is located. This promotes municipal objectives of the creation of job opportunities.

Figure 12: Containerised CABs

Source: AECOM (2015)

Figure 13: A view of the inside of a CAB

Source: eThekwini Municipality (undated)

Using containerised CAB means that the units can be removed from a site when formal housing is provided and used in another area when required. The use of this technology also ensures that bulk infrastructure is available when formal houses are provided. Providing CABs does come at a cost though. eThekwini has advised that it currently costs approximately R1 million to install a CAB (male and female). This includes the cost of the containers and connection to the bulk sewer network. A further

R110 million is required annually to operate and maintain the 1100 units the municipality has installed (R100 000 per toilet block per annum).

Ekurhuleni has attempted to provide CABs, but has also noted that the maintenance costs associated with these units are very high despite appointing agents to undertake this work.

The CoJ has provided communal ablutions in certain areas, but have noted that the hygiene in these units are usually poor.

CABs require bulk infrastructure and not all settlements can readily be connected to a bulk sewer network. Space and the mobility of households in the informal settlements are also a challenge that inhibits the installation of CABs and maintenance of the facility.

A further challenge that eThekwini has identified is that using CABs has increased non-revenue water. The increase in non-revenue water is attributed to illegal connections to the water supply of CABs, vandalism and user behaviour (people using more water than is required).

Part of the difficulty associated with CABs is that they are used by many people without sufficient clarity as to who bears responsibility for the toilets: Ekurhuleni has noted that this can attributed to a lack of ownership of the facilities by the community. With poor maintenance, they are thus prone to blockages and unhygienic conditions.

3.3.3 Summary of technical options

Service levels that municipalities can choose to implement are categorised as household, shared or communal. The four metros considered chose to implement VIP latrines, chemical toilets, and sewered sanitation either for individual connections or CABs. Each of the cities engaged in the study has detailed a slightly different approach to providing interim sanitation solutions in informal settlements. The preferred temporary technologies are chemical toilets and CABs. The CoJ is the only municipality that has indicated a preference for installing VIP latrines.

While temporary solutions remain unpopular and costly, chemical toilets and CABs have had some degree of acceptance in the four metros surveyed. However, the costs and social acceptance associated with providing these technologies remain problematic. Looking at longer-term permanent solutions using sewered sanitation, the selection of technology was found to depend on the conditions within the informal settlement and access to the bulk sewer network.

Sewered waterborne sanitation is seen to be the ultimate goal, but the cities see this to be a very expensive option: a view that is contradicted in the analysis presented later in this report. However, formalising informal settlements sufficiently to provide for sewers is a challenge and the approach to informal settlement upgrading has to be improved for this to take place.

CABs are seen to be an acceptable level of service, but does need to be paired with a janitor service to ensure that the blocks are maintained and cleaned properly. The costs of these units are high and can increase non-revenue water.

3.4 Upgrading of Informal Settlements

The provision of urban sanitation in informal settlements can be linked to the formal housing programme or the provision of services in informal settlements. This section of the report highlights the challenge associated with upgrading informal settlements in situ, as well as challenges that can inhibit the relocation of informal settlements.

3.4.1 Classification of informal settlements

There are four main categories of developmental response for providing basic infrastructure and housing in informal settlements (Table 12) (Housing Development Agency, 2014):

Table 12: Categorisation of informal settlements

Category	Description
Category A	• Full upgrading consisting of full services, top structures and formal tenure (i.e. formalisation) where appropriate, affordable and viable. • The rationale for this category is that the site is viable and appropriate for formalisation. In addition, the project is implementation ready (land has been secured, feasibility studies are complete, plans approved, etc.)
Category B1	• Interim[10] basic services (leading to eventual formalisation) where informal settlement sites are viable and appropriate, but where such formalisation/full upgrading is not imminent. • The rationale for this category is that the site is viable and appropriate, but that the project is not yet implementation ready. There could be significant delay in formalising due to factors such as land acquisition or bulk services provision. • Interim services are deemed to consist of improved sanitation, for example, VIP latrines and CABs.
Category B2	• Emergency basic services for informal settlements where long-term formalisation (full upgrading) is not viable, but relocation is not urgent or possible. • The rationale for this category is that the site is not viable or appropriate, but no urgent need for relocation is required. Serious health and safety threats can be mitigated in the short term by basic services provision. • Emergency services may be considered to be at a similar or lesser level to Category B1 interim services. The key difference between Category B1 and B2 is that B2 is unlikely to be formalised.
Category C	• Settlements where there is an immediate health or safety threat rendering the site unsuitable for housing even in the short term. Relocation is the only resort. • Rationale for this category is that the site is not viable or appropriate. Health and safety threats cannot be mitigated in the short-term through basic services provision.

Table 12 was developed to shift the traditional approach on informal settlements from a philosophy of eradicating informality towards a more rapid and inclusive process of providing basic service to informal settlements (in situ) along with basic, function tenure (Housing Development Agency, 2014:5). It is therefore important to understand the challenges that prevent municipalities from conducting in situ upgrades in informal settlements.

3.4.2 Primary constraints to informal settlements upgrade

Table 13 presents the hard constraints to informal settlement upgrading, as noted in the Western Cape study.

10 The use of interim and temporary is used interchangeably within this report.

Table 13: Primary constraints for providing sanitation in informal settlements

Hard constraint	Implication for sanitation provision
Located on privately owned land	Unless there is a health risk, interim services cannot be put in until the site has been purchased by the relevant authority. Services will have to be located on nearest municipal land.
Within floodplain	Upgrading may condone or encourage a potentially life-threatening situation. A water use licence and environmental approval would be required for any permanent (or semi-permanent) services to be installed.
Localised flooding	A high water table means that on-site systems have to be watertight, but even so, flotation of the tank may be a problem. High water tables may make waterborne systems difficult to install and operate due to storm water ingress into manholes and pipes.
High density	Possibly insufficient space for toilet facilities (individual or communal) or pipes. Formal upgrading may mean some relocation. See below for further discussion.
Hard rock	On-site systems that rely on soakaways cannot be used. Construction of any subterranean infrastructure (pits or pipes) is very expensive.
Unstable soil	Pit construction is expensive. Pipes can be damaged by ground movement.
Steep slope	Construction is expensive, but this relates more to other services than sanitation because steep slopes aid gravity flow. Slopes can make pit emptying difficult.
Located in a servitude	Settlement is problematic due to the implications for access to the infrastructure protected by the servitude or the potential damage to these servitudes. Not a physical constraint to sanitation per se, unless the servitude relates to underground infrastructure, which would clash with sewers or where there are overhead powerlines.

The classification of a primary constraint is noted as being somewhat subjective, which is therefore likely to be contested. However, Table 13 does indicate some of the challenges that a municipality may face when rolling out sanitation solutions in informal settlements. Only the location of settlements on a floodplain or location beneath high voltage powerlines represents insurmountable obstacles to permanent development. In dealing with other factors there are technical solutions in most cases, assuming some degree of reblocking of the settlement.

Reblocking of settlements is a process of rationalisation and reconfiguration of dwellings and their respective stands, with the input of, and in cooperation with the community. The purpose of reblocking is primarily to logically plan for service provision (including roads, water, sanitation, storm water) in high-density settlements with a shortage of space. The rationalisation of location and orientation of dwelling stands not only provides engineering services access through grid layouts, but can also further dramatically reduce the overall footprint of a settlement as space utilisation is improved. However, in certain cases, informal settlement densities may be physically too high for reblocking to create the necessary space required for engineering services. In such instances, relocation of volunteer households is required.

The Western Cape study (Annexure B) discusses the impact of density on the ability to provided sanitation in more detail, and points out that a simple calculation of dwellings per hectare is inadequate

to determine what type of sanitation can or cannot be provided. Individual site surveys are required to assess appropriate technologies on a case-by-case basis.

While the process of in situ informal settlement upgrading is complex and time-consuming, it has many benefits. These include effective land use (where settlements are in good locations) and the social benefit of keeping the community together, with its community network safety nets, while using the upgrading project to build community spirit. Furthermore, the extremely high densities of many informal settlements, particularly those that are well-located, often pose insurmountable challenges to land availability in large cities if greenfield relocation were to be used at scale. However, municipalities often are reluctant to undertake in situ upgrading. They compromise by providing temporary sanitation solutions in these areas often with the belief that households can be relocated to more suitable areas as part of the formal housing programme. But, this frequently does not happen, which condemns people to living informally for years or decades with interim services.

An example of new acceptance of in situ upgrading is provided by the CoJ. They have noted that relocating residents from settlements where they have located is a far more emotive issue than just the technical considerations of the land. Residents living on the land often work close to their homes and children are enrolled in schools close to the settlement. The needs of residents also need to be considered when residents are to be relocated.

3.4.3 Acquisition of land

Land acquisition in good locations is obviously important both for first-time home seekers in the municipality, and for those who need to be relocated from informal settlements, which cannot be developed in situ.

All municipal water and sanitation departments that were engaged during the course of the study advised that the acquisition of land for greenfield housing projects was managed by the human settlements department in the municipality. The water and sanitation unit is not involved in this process. This can lead to instances where land is acquired in areas that do not have access to the bulk sanitation network or there is insufficient capacity available in the bulk network. The water and sanitation unit will thus be required to adjust capital expenditure programmes accordingly.

3.4.4 Interim and emergency solutions

The categorisation of informal settlements also notes the differentiation around interim (or temporary) services as compared to emergency services. Interim services are considered to be “some form of improved sanitation (such as VIP latrines and CABs)”, while emergency services may be at a lesser level to this (Housing Development Agency, 2014:13). One of the key differences between considering interim and emergency solutions is that an emergency can be considered as a threat to the health and safety of residents. Interim solutions are where there is no emergency, but services are provided at a level that is sufficient to maintain health and safety. Nonetheless, the service level is below what is used as the long-term solution in the area and the intention is to upgrade the level of service in the medium term.

However, the definition provided above does not provide clarity around what constitutes an emergency situation where emergency solutions can be employed. It is important that the definition of an emergency situation is clear as there are several implications. For example, section 29 of the MFMA states that the mayor of a municipality may in emergency situations authorise unforeseeable and unavoidable expenditure for which no provision has been made subject to certain conditions. In addition to this, section 36(1) states that the municipality may dispense with the official procurement process in an emergency situation.

The SJC has also highlighted the need for clearly defined time periods related to interim and emergency sanitation solutions. The organisation has stated that 73% of toilets provided to informal settlements in Cape Town are temporary toilets, but argues that informal settlements are demonstrably not temporary, with 80% of settlements having existed for over 10 years. In addition, the Western Cape study (Annexure B) found that 76% of settlements were not categorised as requiring immediate location, which means that they are intended to be provided with some type of interim or permanent sanitation service in situ.

3.4.5 Providing services on privately owned land

Municipal participants in the study noted the limitations that municipalities have in providing services on privately owned land, which is a factor mitigating against in situ upgrade. However, eThekwini has implemented a process where services can be installed on privately owned land. This process involves engaging with owners and obtaining permission to occupy agreements. Council has approved commandeering rights for EWS. EWS can thus provide services and charge the owner the applicable tariff if the owner does not provide a permission to occupy.

Box 1: Servicing informal settlements on private land

Servicing informal settlements on private land

The DWAF "Guide to Ensuring Water Services to Residents on Privately Owned Land" states that there is no legal impediment to "the use of government grants to fund infrastructure for a poor household on private land not owned by that household, provided that the intermediary (private landowner) makes financial contribution" (DWAF, 2005:14).

However, the word 'intermediary' has a specific meaning in the water services sector, with a water services intermediary being "any entity that is obliged to provide water services to another in terms of a contract where the obligation to provide water services is incidental to the main object of the contract" (Water Services Act, 1997: Section 1). It is often used to refer to private landowners (e.g. farmers) providing water to legal residents on their land. "In the case of informal settlements where there are no implicit or explicit contracts with residents, landowners are not intermediaries. WSAs still need to provide services to residents, either where they currently live, or where they may be relocated to, in terms of the spatial planning decisions in the IDP." (DWAF, 2005:13)

However, South Africa still needs to adhere to the requirements of the MFMA (No. 56 of 2003), which has been cited by municipal interviewees as the main constraint prohibiting municipalities from servicing private land. There is nothing in the MFMA that specifically prohibits the construction of services on private land. Rather, the MFMA specifies that municipalities need to adhere to generally recognised accounting practices (GRAP). In terms of GRAP, any capital expenditure on a specific capital asset that is financed by external funding (loan) must appear on the asset register. As capital improvements accede to the land, it is argued that the installing of municipal services infrastructure will no longer be owned by a municipality and therefore cannot appear on the asset register. Such capital expenditure not resulting in an asset would be considered fruitless and wasteful expenditure by the Auditor-General. This provision has generally been interpreted as a blanket prohibition on installing services on private land.

In 2011, the City of Cape Town stated it was in the process of drafting a by-law that would allow it to install basic services such as water and electricity at informal settlements on privately owned land without the owner's permission (Jooste, 2011). However, no evidence of further action on this matter was found in publicly available sources.

eThekwini took the approach of providing interim services to informal settlements on private land and then following a purchasing or expropriation process to regularise the expenditure (Adrian Peters, Head: Strategy, eThekwini Municipality, personal communication, 14 December 2015).

The recently released draft sanitation policy states that, “The use of the grants to provide basic sanitation services to households on private land is supported” (RSA, 2016:10). It then goes on to refer to farm dwellers and mine employees only and not informal settlement residents. This remains a legally grey area that requires discussion with National Treasury.

Source: Adapted from Western Cape Study

3.4.6 Access to toilets

It has also been noted that it is difficult for residents of informal settlements to access toilets due to the distance from their homes. Key of Hope noted that a child with which they had worked with has to walk more than one kilometre to use a toilet at a garage far from her home.

Access to a communal toilet at night is also seen as a challenge due to safety concerns of residents, particularly at night. This applies to CABs and shared chemical toilets that may be located a distance from the homes of residents. The safety concerns of residents are highlighted by the recent murder of Khayelitsha teenager, Sinoxolo Mafevuka, on 2 March 2016. Ms Mafevuka was found dead in a communal toilet about 150 m from her home (Francke, 2016).

eThekwini has tried to improve safety around the CABs by ensuring that areas around the facility are well lit. However, this introduces a further challenge of illegal electricity connections and the theft of electricity.

3.4.7 Summary of informal settlement upgrading challenges

There are several challenges that make it difficult for municipalities to upgrade informal settlements in situ. However, of the primary constraints identified, only a few (such as location in a floodplain or under high voltage powerlines) represent an insurmountable obstacle to permanent development on the site on which the settlement is located. This, of course, assumes that some degree of reblocking is possible. Relocations of settlements must not be seen purely from the technical or financial viewpoint, but also consider the human element.

While efforts continue to be made to provide access to adequate sanitation, providing adequate and sustainable sanitation in informal settlements has been beset with difficulties. Municipalities have faced practical difficulties in managing temporary sanitation solutions. They are universally disliked by residents for a range of reasons including distance from house to toilet, difficulties in sharing toilets, lack of comfort and poor maintenance. Further, there is evidence that these temporary solutions are proving to be expensive if applied over a medium to long term.

This leads to the criticism that temporary sanitation provisions are not temporary at all: The SJC states that most temporary sanitation solutions have been in place for the past ten years. However, while municipalities argue that they are unable to provide permanent waterborne sanitation solutions due to, inter alia, settlement conditions, amount of water required, cost and landownership, there is a need for a new way of thinking about informal settlement upgrade and the associated sanitation solutions.

3.5 What Do Residents Want?

3.5.1 The relationship of sanitation technology to housing

The CoJ notes that housing is the priority of people living in informal settlements. Residents sometimes feel that providing VIP latrines after they have occupied a piece of land for 20 years is a delay tactic employed by the municipality to avoid providing housing. The result is that the community is resistant to the installation of VIP latrines, but the issue is more about the housing process.

A respondent from an organisation representing the interests of communities stated that residents would probably be willing to accept a VIP latrine if it was provided with a formal housing structure. However, the nature of an informal settlement may mean that this is always possible.

3.5.2 Technology selection

There are conflicting views on what level of service residents are willing to accept in informal settlements. Some municipal officials believe that residents are only willing to accept full waterborne sanitation while others have stated that residents are not resistant to any form of sanitation provided as it is usually an improvement on their current situation. There are also conflicting views between organisations who represent the interests of communities. Some state that residents want water and flush sanitation technologies while other state that communities are willing to accept VIP latrines and CABs.

Key of Hope has seen CABs working well in certain communities. The organisation has also seen similar units being rendered unusable and closed up within a year in other communities. A key element of the process is engaging the community and appointing a janitor. This contributes to support from the community.

The CORC has had some success in introducing technologies, such as Enviro Loos, to communities. This was done by ensuring that the new technology closely resemble a flush toilet and has the same benefits. The CORC has also taken members to areas where new technologies have been implemented to expose them to the technology. This creates buy-in on the part of communities. Further to this, the community is allowed to be involved in the design of the application of the technology in their area. This does take time. Allowance must be made in the project timeframe for the time required for communities to engage and devise their own solutions.

3.5.3 Infrastructure that works

A further problem is the state of disrepair of existing infrastructure. There have been instances where failing infrastructure has been reported to the municipality but has not been repaired for years. In some cases, even temporary facilities are in such a state of disrepair that residents cannot use them. Municipal officials have advised that high densities and the informal nature of the settlement inhibit the ability of municipal staff and/or contractors to access toilets.

Part of the challenge of temporary solutions is that municipalities often rely on private service providers for servicing. Municipalities struggle to monitor these service providers and hold them accountable. Communities are often left to deal with the problems of poorly performing service providers themselves.

3.5.4 More community engagement

Africa Ahead considers the key to resolving sanitation issues to be the mobilisation of the community prior to developing infrastructure. The organisation believes that this enables communities to develop ownership of the infrastructure, and improves the likelihood that the community will use and maintain

the infrastructure correctly. While this is seen to be a more time-intensive approach, it is regarded as likely to produce better outcomes.

The SJC also argues that municipalities do not conduct proper engagement at the appropriate time. Citizens are not given the proper space to give input into the budget and plans. There is also a lack of engagement when there is protest, as a memorandum is usually handed over without any discourse. There is no space for communities to continually engage with city officials, only with politicians. The communities would prefer to engage with officials or, in the case of outsourced services, the service providers themselves.

One of the problems that the SJC identifies with the city is that the spaces that exist for public participation are not functional and are not working to effect what they were created for. The municipality still want people to engage in the formal invited spaces such as IDP meetings, rather than to engage the communities. However, communities do not feel comfortable engaging in these formal spaces. The SJC argues that public participation would achieve far better outcomes using invented spaces, which were created by the community, where community members feel more comfortable raising their issues, but officials are reluctant to attend these engagements.

eThekwini Municipality has also experienced difficulties with residents who are not willing to accept technologies other than waterborne sanitation. If there is good reason waterborne sanitation cannot be provided, this requires an ongoing intensive interaction with the community. This is an important part of the community engagement process as municipal officials state that alternative technologies can be implemented if the community is engaged correctly and the reasons as to why waterborne sanitation is not possible are explained. Failure to correctly engage the community effectively can result in the infrastructure that has been installed being used incorrectly or damaged.

Trust

The main barrier that CORC has identified to engaging communities is lack of trust between the municipality and the community. Organisations engaging with communities run the risk of making promises that cannot be fulfilled, which breeds distrust. The engagement with communities must therefore be honest and open with full sharing of information on options and constraints.

eThekwini has also noted that residents can begin to distrust municipal officials if they only appear during the municipal election campaigning period. EWS has therefore focused on building an effective customer services and liaison department that is well resourced to engage with the community. The team is mandated to liaise with councillors and community-based leadership structures.

Success stories

Africa Ahead has developed the Community Health Club Model in response to contemporary community health challenges and approaches to address them. It was identified that the methodologies in use at the time were not galvanising sustained change in the communities where they were applied. The methodology involved creating small clubs, localised around an individual piece of infrastructure, such as an ablution block, and discussing health issues, and solutions to these. These start out focusing on issues related to hygiene and evolve in conversations on deeper issues, resulting in the community taking responsibility for ensuring there are solution to their sanitation issues.

Africa Ahead ran a small project in eThekwini Municipality to improve the living standards of the residents of the Joanna Road informal settlement. It was relatively well serviced by the municipality with ablution blocks, standpipes and solid waste removal, but the area was very problematic in terms of health and hygiene. The project focused on cleaning up the informal settlement and getting residents

to use the ablution blocks better. The project was however too small to be sustainable; it needs to be scaled up.

The CORC has assisted the City of Cape Town, helping them review the agenda of upgrading informal settlements and water and sanitation issues such as where in settlement the city should install toilets by engaging both the city's engineers and communities. They support communities in planning space to allow the city to provide the infrastructure services in processes such as the reblocking of settlements.

eThekwini Municipality has overcome several challenges to install and operate over a thousand CABs within the city. A key feature of this initiative is applying a community engagement model. The city works closely with the local community structure to plan, operate and maintain these facilities (Figure 14). The local community structures are empowered to make decisions around the location of the CAB, operating hours and the selection of the janitor responsible for the facility.

Figure 14: Local community members engaged at Parkington informal settlement

The involvement of the community in the decision-making processes does not always lend itself to success. This must also be paired with the city continuously working with the local structures to repair and maintain facilities.

3.5.5 Residents view on municipalities

NGOs have played a key role as development facilitators between municipalities and communities. However, they are not able to cope with the large numbers of communities requiring support and are not able to compensate for systemic problems in the way sanitation is provided.

Africa Ahead noted that some communities feel animosity towards municipalities due to the perceived lack of care attributed to failing to repair infrastructure and a view that the situation is not going to be improved. Generally, expectations are low that the municipality will act to improve the situation.

Africa Ahead's experience of engaging with municipalities has been largely positive with a degree of dependence on having a champion for the project: projects are successful when specific individuals within the municipality are made responsible for achieving certain goals. However, projects may fail once the project person leaves. This may occur when officials are replaced at the end of five-year employment terms, for example.

The responsibilities of the community to the municipality also need to be recognised, specifically with respect to payment for services. A large portion of the population are living in poverty and many are unable to pay for municipal services. While these affordability limitations are provided for under the free basic services policies applied by municipalities, it remains necessary for those households who are not poor to pay their bills. Often they are unwilling to do so, which puts the municipality under financial pressure.

3.5.6 Summary of resident preferences

There are conflicting views around the level of service that residents living in informal settlements are willing to accept. Some participants in the study stated that residents are not willing to compromise on service levels lower than full waterborne sanitation while others stated that residents living in informal settlements will accept temporary solutions if they were seen to work.

It is evident that there is often mistrust between municipalities and communities. Communities typically consider that municipalities do not conduct effective public participation processes, which typically results in any temporary solution failing. The variation across settlements and communities is also evident: interviewees noted that the same level of service may work in one area and fail in other if the proper community engagement processes was not followed.

3.6 Summary of Stakeholder Engagement

3.6.1 Institutional challenges

Coordination between the complementary mandates of the human settlements, and water and sanitation departments in the municipality is a challenge. Decisions around settlement development and sanitation solutions are also subject to political influence. While there may be good reason for political decisions, changes in the political landscape can delay the delivery of services by the municipality.

It was noted that part of the challenge was that municipalities are reluctant to change the way in which they have done things to respond to the needs of communities. That said, three of the four metropolitan municipalities have recently gone through a restructuring process to deal more effectively with water and sanitation provision. Municipalities are also facing a skills shortage as skilled practitioners retire or mover closer towards the age of retirement.

Another shortcoming with current arrangements is the weak relationship between municipalities and civil society organisations who have the potential to facilitate informal settlement upgrading projects.

3.6.2 Funding

Municipalities state that they currently are experiencing a funding shortfall between the funding required to operate, maintain and finance new infrastructure and infrastructure renewal. The shortage of capital is partly attributed to the levels of transfers being lower than they should be and partly due to constraints on raising debt finance. Often the lack of political support within the municipality for requested water and tariff increases is a key limitation.

The funding gap is expected to widen as the municipalities engaged in the study stated that they have ageing infrastructure. This position is further exacerbated by expenditure on maintenance and renewal is cut based on budget cuts. Thus, municipalities could be in a position where capital expenditure that is being deferred could result in rapidly increasing costs of infrastructure renewal in future.

However, simply increasing the funding allocation to municipalities will not solve the problem. These institutions face systemic challenges that also need to be addressed to ensure that the additional funds are not wasted. Further to challenges already noted, municipalities may lack the capacity to deliver on additional capital projects and the procurement processes can also delay service delivery.

3.6.3 The technology question

Despite the progress made by most of the municipalities, there are many communities in informal settlements that do not have access to adequate sanitation.

All interviewees stated that the permanent sanitation solution of choice for the municipality would be a waterborne sanitation connection. However, due to various constraints, temporary solutions are widespread with each of the municipalities engaged having different approaches in providing such temporary sanitation solutions. Each of the technologies have their merits and disadvantages based on the location, density and site conditions of the settlement.

But, all temporary solutions have their shortcomings. Most important of these are the access – distance and safety related – to shared toilets with this being particularly problematic at night due to safety concerns. Also, lack of ownership of toilets and weak performance by service providers lead to poorly maintained facilities that are unpleasant to use or completely unusable. One reason for poor maintenance of facilities in informal settlements is that municipalities have difficulties in gaining access to complete operation and maintenance tasks.

It was noted that some of the temporary sanitation has been in place for extended periods of time, which renders the question: are these temporary solutions in the first place?

In considering long-term solutions based on full waterborne sanitation, there are arguments that this may in fact be cost-effective as the operating costs of CABs and chemical toilets are so high. However, long-term solutions in the case of informal settlements require the formalisation of these settlements so that they can be upgraded in situ. But, often this does not get enough political support and, in any event, the process of developing settlements in situ is long and complex. It is essential that this gets substantially more attention.

3.6.4 In situ upgrading of informal settlements

There many challenges that make it difficult for municipalities to upgrade informal settlements in situ. However, of the primary constraints identified, only a few represent insurmountable obstacles to permanent development on the site where the settlement is located. Most other constraints to in situ development can be overcome and should be addressed to gain the social benefits to people who can continue to live in what are often good locations.

It is acknowledged that there are certain cases where informal settlements cannot and should not be upgraded where they are. These cases include, for example, where an informal settlement is located within the 1:50 year flood line of a river, in a wetland, particularly those of high ecological value, and where settlements are located within a servitude. However, this is typically the exception rather than the norm: mostly informal settlements are in locations where permanence is possible.

While efforts continue to be made to provide access to adequate sanitation, providing adequate and sustainable sanitation in informal settlements has been beset with difficulties, one being the practical difficulties in managing temporary sanitation solutions. These difficulties include the distance from house to toilet, difficulties in sharing toilets, lack of comfort and poor maintenance. There is also evidence that these temporary solutions are proving to be expensive if applied over a medium to long term.

3.6.5 Community engagement

There appears to be conflicting views around the level of service that residents living in informal settlements are willing to accept. Some participants in the study stated that residents are not willing to compromise on service levels lower than full waterborne sanitation, while others stated that residents living in informal settlements will accept temporary solutions as long as they were seen to work. But, there is universal agreement on the need for sound and persistent processes for community engagement around settlement development and sanitation solutions in particular. The evidence from the interviews is that the same level of service may work in one area and fail in other if the proper community engagement processes have not been followed.

Community

Some communities may feel animosity towards municipalities due to the perceived lack of care attributed to failing to repair infrastructure and a view that the situation is not going to improve. The reality is that often communities do not expect much from municipality, but one of the theories that abound is that these residents expect water, sanitation, electricity and housing at little or no cost. Much depends on the commitment of the municipality to hold community meetings over planning and project implementation with representative community structures.

A municipal perspective

A municipality faces the systemic problem of post-apartheid South Africa with a large portion of the population living in poverty and being unable or unwilling to pay for services. The government has the obligation to provide services to poor households; however, the current economic climate makes it difficult for the government to raise revenue via taxes. This results in the funding available to municipalities being inadequate to provide free services to residents and sustainably operate their business.

4 FINANCIAL ANALYSIS

The financial analysis has two components:

- Comparative assessment of relative costs of various technologies applied in South African informal settlements.
- Assessment of different service provision strategies for informal settlements in four South African metros, namely, Ekurhuleni, eThekwini, Johannesburg and Tshwane.

4.1 Individual Technology Assessment

The following technologies were assessed, with descriptions of them given in Section 2.6. A summary is given in Table 14:

Table 14: Description of technology options investigated

Technology	Description
VIP latrines	VIP latrine with pits desludged at a regular interval (at least five years) by the municipality or a service provider contracted by them. It is assumed that the waste is treated by the municipality.
Urine diversion	Urine diversion pit latrines with the same desludging regime as VIP latrines.
Chemical toilets (1:5 ratio)	Chemical toilets in individual privies located along roads or other public places with a toilet shared between five households.
Communal toilets (1:5 ratio)	Communal toilet block – either in a container or building – with the assumption that there are eight toilets in the block, as well as washing and showering facilities. Each toilet is shared by five households (40 households per block). The block is connected to sewerage network.
Conventional waterborne sanitation	Conventional flush toilet in each house connected to a sewer that is part of a city-wide sewer network with centralised waste water treatment. The assumption is that each house has a water connection.
Innovation sanitation	Low-flush toilet units in each house instead of conventional flush, which are connected to a sewer but with decentralised waste water treatment works instead of large scale centralised works.

The portable flush toilet (porta potty) option was not investigated primarily as it was not widely applied in the four metros where this research was focused.

Volumes of water used, and waste water generated have been calculated using the following parameters:

- Number of people per household: 4.
- Number of toilet flushes per person per day: 4.
- Volume of water per flush – conventional: 6 litres.
- Volume of water per flush – low flush: 2 litres.

4.1.1 Costing

Costs were obtained from a range of sources and are summarised in Table 15.

Table 15: Source of costing data

Technology	Source of data
VIP latrines and urine diversion	Information provided by metros – standardised for all metros.
Chemical toilets (1:5 ratio)	Information from metros with specific cost for each metro applied.
Communal toilets (1:5 ratio)	Information sourced primarily from eThekwini Municipality as they have the longest experience with this technology.
Conventional waterborne sanitation	Figures taken from the Municipal Services Finance Model with model runs recently completed for all metros for National Treasury. This includes capital costs of water supply (internal, bulk and connector infrastructure), sanitation capital costs (internal bulk and connector) and operating costs for water and sanitation systems (internal costs including internal reticulation operation and maintenance, consumer interface costs, metering and billing as well of costs of operation and maintenance of bulk and connector systems). Provision for finance charges and depreciation is included.
Innovation sanitation	Costs as for conventional waterborne sanitation but with adjustments to increase capital cost of decentralised waste water treatment works (See PDG, 2016). With lower flush volumes, the extent of bulk and connector infrastructure is reduced as is the cost of supplying water and treating waste water.

The costs used in the analysis are given in Table 16.

Table 16: Capital costs applied in the analysis

Technology and cost component	Capital costs per household (R)		Operating cost per household per year (R/year)	
VIP latrines (1:1 ratio)		10 000		1 800
Urine diversion (1:1 ratio)		10 000		1 800
Chemical toilets (1:5 ratio)		0		3 850
Communal toilets (1:5 ratio)		24 420		2 450
- Sanitation internal	20 000		1 670	
- Sanitation bulk and connector	1 630		200	
- Water supply internal (flushing share)	1 000			
- Water supply bulk and connector	1 790		580	

Technology and cost component	Capital costs per household (R)		Operating cost per household per year (R/year)	
Conventional waterborne sanitation (1:1 ratio)		19 290		1 140
- Sanitation internal	10 900		360	
- Sanitation bulk and connector	1 600		200	
- Water supply internal (flushing share)	5 000			
- Water supply bulk and connector	1 790		580	
Innovation sanitation (1:1 ratio)		14 943.2		710
- Sanitation internal	8 800		450	
- Sanitation bulk and connector	540		70	
- Water supply internal (flushing share)	5 000			
- Water supply bulk and connector	590		190	

4.1.2 Model structure

The modelling was done in Microsoft Excel™. The logic and structure are presented in Figure 15.

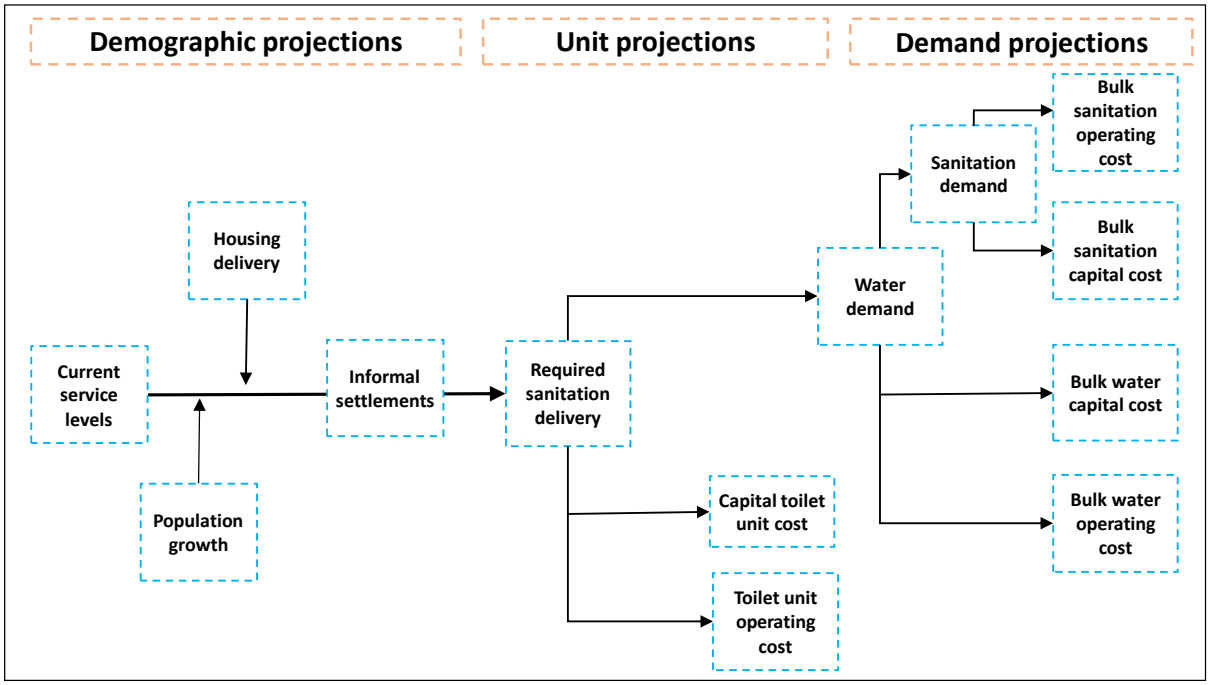

Figure 15: Model structure

4.1.3 Modelling limitations

It is recognised that there is considerable variation in these costs and some of them are estimates. But, they are considered robust enough to show relative scale of life cycle costs. Individual local circumstance of informal settlements and the inherent variance in geographic constraints to service provision were not considered in the modelling; however, the aggregate costs are believed to account for these on a municipal wide scale.

4.1.4 Results of individual technology costing

The results are shown for the cumulative costs – capital and annual operating costs – over a ten-year period. A nominal costing approach is taken, which means that annual operating costs need to be inflated, with an inflation rate of 6% applied. Figure 16 summarises the results:

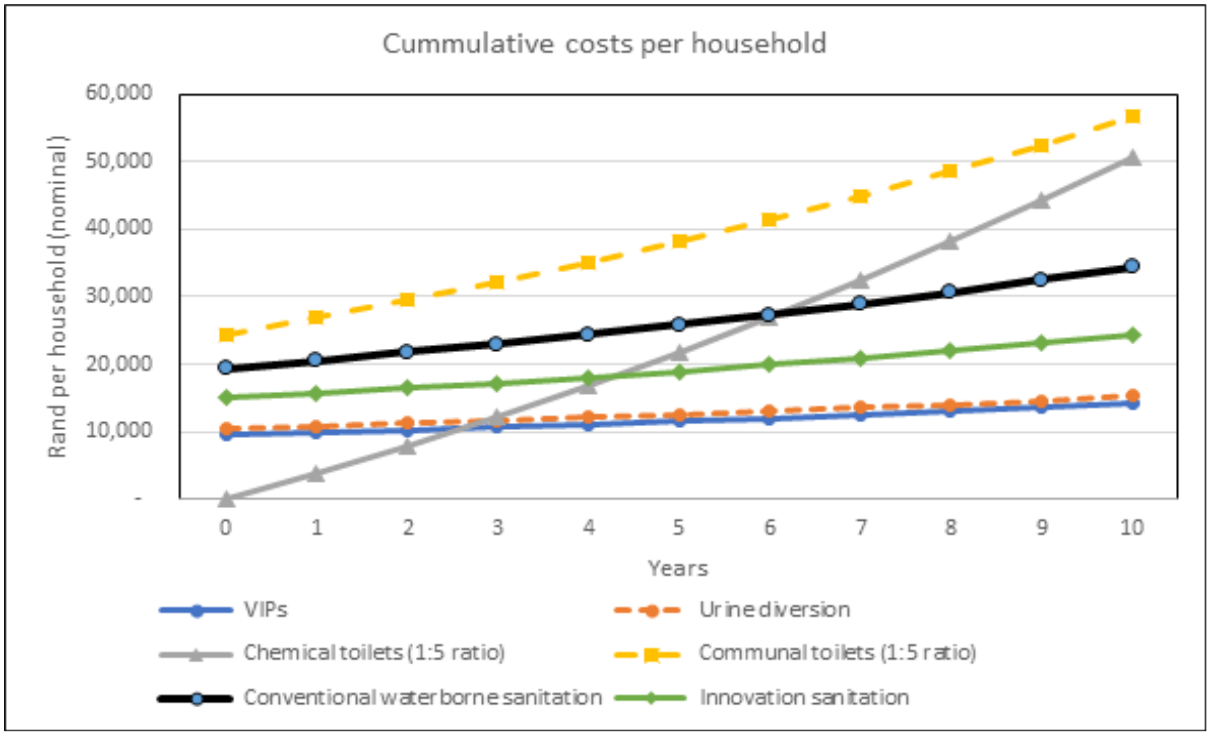

Figure 16: Comparative costs of technology options

These results are interpreted as follows:

- The costs of ***conventional waterborne sanitation*** are considerably higher than those found in other studies (PDG, el al., 2016; Barbeton et al., 2016). This may well be because this analysis includes all water infrastructure required and the bulk and connector sanitation infrastructure. Nevertheless, conventional waterborne sanitation becomes increasingly cost-effective over time and, of course, provides the highest level of service.
- In the case of on-site dry sanitation systems – VIP latrines and urine diversion – these track each other as the same cost structure is used for both. Operating costs based on recent experience have been applied. Although pit emptying in dense informal settlements can be expensive and the cost of treating the sludge is also a factor, these operating costs are the lowest of the options considered. The result of this, coupled with relatively low capital costs, means that dry on-site systems have the lowest financial impacts; however, the service level is relatively low as the toilets are not located in-house. ***Chemical toilets*** have very high operating costs per household, even when they are shared between five households. At this ratio they provide a low level of service – probably the lowest of all the technologies – and their life cycle costs are higher than for conventional waterborne sanitation provided to each household after six years. The Western Cape study (Annexure B) showed that the allocation to sanitation used in the Equitable Share formula was adequate to operate and maintain waterborne sanitation but was not sufficient to maintain chemical toilets. This indicates that municipalities would have to provide a portion of their own funding, or cross-subsidise from other services, to fund these units.

- ***Communal toilets*** are shown to be the most expensive option due to high capital costs (estimated at R800 000 per block including sewer and water connections) and high operating costs (R65 000 per year, which includes for the janitor and all maintenance costs). The service level is relatively low as toilets are not in, or at the house and users have to walk to the toilet block to use the facility.
- The ***innovative sewered system*** option, comprising low-flush toilets and decentralised treatment, is less costly than a conventional system mainly because of the substantially lower flush volumes used. The feasibility of decentralised treatment has not been tested in this study and cannot be applied universally. In particular, there may be human resource capacity constraints to manage multiple decentralised treatment works in one municipality.

4.2 Assessment of Informal Settlement Sanitation in Four Metros

The financial modelling of the capital and operating costs required to service the backlog and future growth in four metropolitan municipalities at varying service ratios and using differing technology types was also conducted. The municipalities analysed with a summary of assumed existing informal settlement arrangements is given in Table 17.

Table 17: Summary of existing sanitation arrangements in informal settlements in four metros

City	Number of households in informal settlements	Existing sanitation situation (% of households with access to service)
Ekurhuleni	163 000	12% waterborne sanitation; 12% chemical toilets; 2% VIP latrines. Rest assumed to use unimproved sanitation.
eThekwini	239 000	11% waterborne sanitation; 8% communal toilet blocks. Rest assumed to use unimproved sanitation.
Johannesburg	126 000	16% VIP latrines; 3% chemical toilets. Rest assumed to use unimproved sanitation.
Tshwane	111 000	4% VIP latrines; 11% urine diversion toilets. Rest assumed to use unimproved sanitation.
Note: the data on informal settlement services is generally not good and, while some information was made available in interviews, assumptions on service levels have had to be made by the research team in some cases using Census 2011 data.		

4.2.1 Methodology

In order to address the above objectives, three differing sanitation technology mixes were considered for each municipality. Each was modelled at three differing unit delivery levels over a 20-year period. Therefore, nine differing service provision and technology mix scenarios, and the associated costs, were modelled for each municipality. However, only four have proved useful in showing the relative costs of technology options, as shown in Table 18.

Table 18: Modelled service provision scenarios

Scenario	Description
Scenario 1 Existing technology mix for each metro rolled out to target coverage	The existing technology mix is kept, but with level of access by households improved to a target ratio of toilets per household. This target ratio is based partly on discussions with city officials, modified by the research team (See Table 19).

Scenario	Description
Scenario 2 Existing technology applied at one toilet per household	In this scenario, no new technologies are introduced but existing technologies are applied at a ratio of one toilet per household. In the case of communal toilets, this does give a rather artificial result where each household has its own toilet in a communal block.
Scenario 3 Sewered waterborne sanitation to each household	In this scenario, the service ratio is achieved using conventional sewered waterborne sanitation only with each household having a toilet in-house.
Scenario 4 Sewered waterborne sanitation with technology innovation	This scenario models providing low-flush toilet units in each house instead of conventional flush, with decentralised waste water treatment works instead of large scale centralised works.

In the case of Scenario 1, which applies existing technology but with improved access, the provision is made for each metro as shown in Table 19:

Table 19: Target for service access for Scenario 1

City	Target service level mix (percentage household with service)	Ratio of households per toilet
Ekurhuleni	Waterborne 5%; Chemical toilets 60%; Communal toilets 35%.	Ratio 1:5 for chemical and communal
eThekwini	5% waterborne; 95% communal toilets.	Ratio 1:5 for communal
Johannesburg	60% VIP latrines; 40% chemical toilets.	Ratio 1:5 for chemical
Tshwane	100% urine diversion toilets.	

In the case of Scenario 2, the same mix of technology access is used but with ratios of one toilet per household. It has been noted that in the case of communal toilets, this give the rather artificial result that each household will have its own toilet in a communal toilet block.

Figure 17 provides a high-level schematic of how the component costs of each scenario were modelled from current service levels.

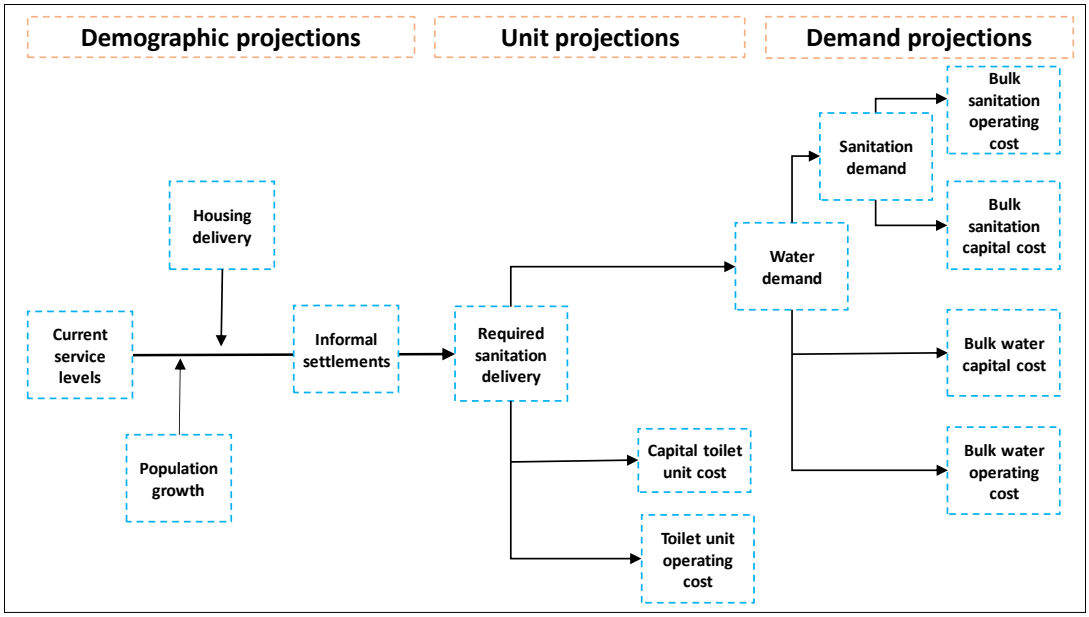

Figure 17: Municipal sanitation provision – modelling schematic

Current service levels for sanitation provision in informal settlements were provided by each municipality where possible. If these were unavailable, Census 2011 figures were used to supplement the data. Subsequently, the model projects informal population growth for each municipality based on historical census data. The growth in informal households is subsequently reduced by the projected subsidised housing delivery, which is projected based on delivery over the last five years. Cumulatively the projected growth and backlog provides the number of unserviced informal households per municipality in 20 years' time.

Unit projections were then calculated based on the required sanitation delivery to achieve a specific scenario's sanitation service ratio. Capital toilet unit costs were applied by unit type per year and the unit operating cost[11].

Box 2: The costs and implications of de-densification

The cost and implications of de-densification

The costing methodology employed in the Western Cape study (Annexure B) differs from that presented above, in that it included the costs of de-densifying informal settlements to provide adequate space for the chosen sanitation solution. The rationale for including this cost is that this is part of the sanitation solution. To provide sanitation for all of the residents originally living in the settlement, one must provide for the cost of the sanitation provided to the area to which households were moved. This could be new greenfield housing with waterborne sewer connections, or a temporary relocation area with more basic sanitation. The Western Cape study concluded that this cost was not insignificant. What is perhaps more relevant than this cost, is the realisation that to provide sanitation in dense settlements, the accompanying housing programmes to accommodate relocated residents would also have to keep pace. In relation to the ambitious targets for sanitation provision in the Western Cape, the study concluded that these could simply not be achieved because of the impact that it would have on the housing programmes.

[11] These unit operating costs are demand neutral costs, such as the cost to rent a chemical toilet per annum or maintain a CAB.

4.2.2 Results for four metros

The results for each of the four scenarios is calculated using the nett present value (NPV) with a discount rate of 4%. In this case, the annual costs over the 20-year period are in real terms (2016 prices); hence the relatively low discount rate. In interpreting the NPV approach it can be stated that if one had the amount of money stated in the results below, one could provide for all the capital and operating costs over 20 years if the money was invested at 4% plus inflation. It is a useful way of comparing options and giving an indication of the amount of money required. The results are shown in Figure 18.

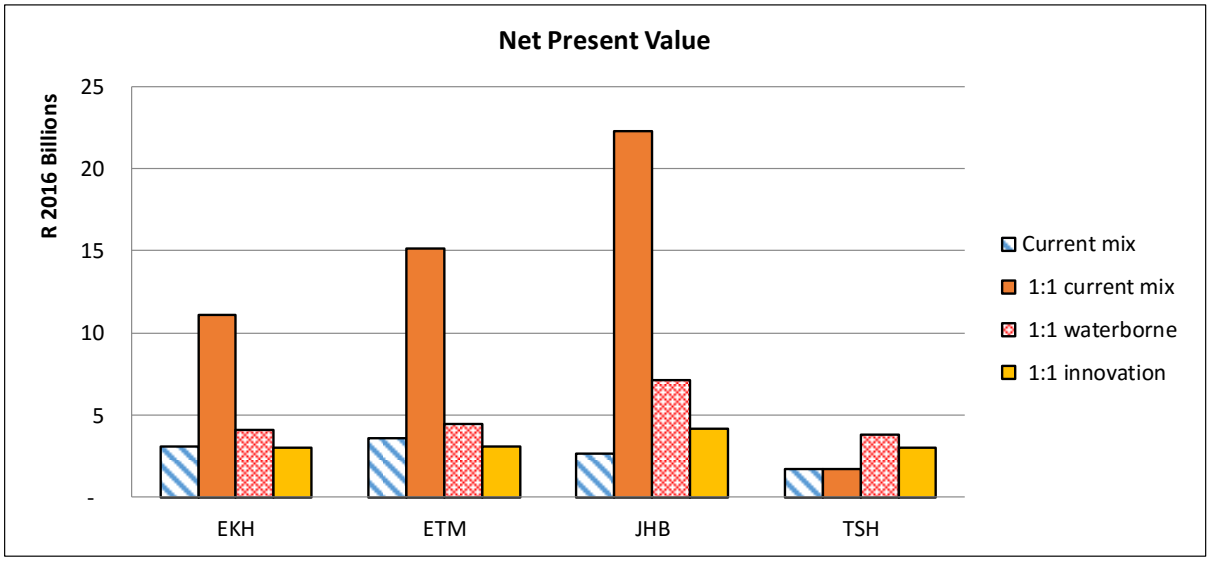

Figure 18: Comparison of sanitation programme costs in informal settlements in four metros – NPV

These results are interpreted as follows:

- Comparing Scenario 1 (current mix) with Scenario 3 (conventional waterborne) for all metros, it is evident that for fairly little additional funding a conventional waterborne sanitation service can be provide to all households: a far higher level of service.
- Comparing Scenario 1 and Scenario 2 (current technology but with one toilet per household) gives very high figures for all metros. This is because of the high cost of both chemical and communal toilets if applied at a ratio of one toilet per household. This is clearly not feasible (as shown comprehensively in the Western Cape study) and, in any event, is not being considered as a reasonable option by any of the metros.
- Comparing Scenario 3 (conventional waterborne) with Scenario 4 (innovative sewerage), the costs of the latter are lower. While the costs of the decentralised waste water treatment works option are held to be higher per household, this is more than offset by the impact of lower water use for flushing.
- Finally, comparing the relative costs across metros it needs to be noted that the cost is not only influenced by the relative number of households currently in informal settlements, but also by the growth figures applied to households in informal settlements. For example, in the case of Johannesburg, the high growth figure assumed (5%) causes the relatively high cost.

If all four metros were to provide waterborne sanitation to informal settlement residents at a ratio of 1:1, it would cost R18 billion in NPV (2016) over 20 years, made up of R11 billion in capital costs and R7 billion in operating costs. In real terms, these four metros would have to spend a total of R832 million per year on capital expenditure to roll out this sanitation infrastructure. The 2016/17 total capital budgets

of these four metros for all sanitation investment (bulk, reticulation, asset renewal, upgrading, new, etc.) is R1.6 billion[12]. Thus, the required investment would represent 44% of current capital budgets. If one extrapolates these numbers to all metros based on the relative proportions of informal settlements, the total NPV of capital and operating expenditure would be R27 billion over 20 years, and the metros would have to spend R1.2 billion (34% of current sanitation capital budgets) on informal settlement sanitation on average every year. These results are very similar to those found in the Western Cape study (Annexure B).

4.2.3 A note on resource demand

A recurring argument against the provision of waterborne sanitation to informal settlements is the added demand that will be placed on an already constrained water supply. However, the analysis has shown that supplying waterborne sanitation at a ratio of one toilet per household located in informal settlements of the four metros analysed, would result in an additional 55.8 million kilolitres per annum for flushing after full roll-out in 2037. This represents approximately 5% of the current water sales volume in the four municipalities. In addition, an estimated 27 million kilolitres of water consumption would be further required due to the provision of household water connections to all informal dwellings in the four metros[13]. This figure takes the estimated 147 million kilolitres that would be consumed through communal standpipes and alternative sources without household connections into account. This cumulatively represents 5% of current system input volumes for the four metros.

12 Sourced from local government budget information provided on National Treasury's website: http://mfma.treasury.gov.za/Media_Releases/mbi/2016/Documents/Forms/AllItems.aspx?RootFolder=%2fMedia_Releases%2fmbi%2f2016%2fDocuments%2fC%2e%20MBRR%20%28detail%20of%20schedules%20A2%20to%20A10%29%2f03%2e%20A5%20Capital%20Budget%20and%20Expenditure%2fExcel&FolderCTID=&View=%7bDD36350A-FBAD-4998-9476-802296ADDBB2%7d

13 This is based on the low-income residential consumption figures in Viljoen (2016).

5 CONCLUSION

The challenges and constraints associated with providing sanitation in urban informal settlements are not technical: they are financial and socio-political. The financial challenges relate not to the availability of finance, but rather to the excessive costs incurred by treating informal settlements as temporary settlements. The socio-political dimension of this approach is that substandard technical options are provided without adequate consultation, which increases community resistance and prevents the type of cooperation that is required to enable higher levels of service to be implemented. Municipal officials lack the skills and the resources to undertake the required engagement and negotiation to implement an appropriate and acceptable solution. In many cases, intermediary organisations (NGOs or CBOs) undertake this faciliatory role. Interviews and literature evidence indicate that a large skills and capacity gap exists in South Africa for intermediary services in settlement upgrading and sanitation provision. Permanent solutions are more financially viable and socially acceptable in the long term. The findings of this study regarding the permanence of informality and the high cost of temporary sanitation solutions therefore indicate that a different approach is required to sanitation.

The literature review illustrated how intractable and widespread the problem of inadequate sanitation is, and that it is concentrated in urban informal settlements. Sanitation is an inherently political issue, and recent examples illustrate how this is particularly the case in South Africa. Bucket systems and chemical toilets have remained where bulk infrastructure is not in place. In other instances, providing sewered sanitation resulted in overloading of waste water treatment works. A further constraint to sanitation provision has been the lack of maintenance and renewal of infrastructure due to insufficient funding and skills in some municipalities.

Interviews with officials showed that one of the main constraints to improving sanitation provision is the lack of capacity, particularly technically qualified engineers, technologists and technicians. In addition, coordination between the funding, planning and implementation functions of the departments providing sanitation services and departments providing housing (human settlements) is problematic in some instances. Changes to senior appointments due to political cycles were also cited as hampering urban sanitation provision and general institutional flux was a common complaint. The inability of officials to influence tariffs and capital budgets for sanitation means that preventative maintenance and system expansion could not happen as required. The municipal interviews also indicated the severe financial constraints of the departments responsible for sanitation provision, but this is often a result of internal prioritisation of grant funding, rather than the absolute amount made available to a municipality. While there is little possibility of capital grant funding increasing, there may be scope for raising sanitation tariffs (in conjunction with water tariffs) from non-poor households.

The DWS recently published the National Sanitation Policy. Position 21 of the policy focuses on economically and financial sustainable solutions, recognising that sanitation has economic value. However, the policy does not go into sufficient detail on the financial aspects of sanitation provision, given that municipal officials tasked with providing sanitation in urban areas have financial constraints. Increased capital and operating budgets would improve delivery to an extent, but the financial realities are that this is not likely: own revenues are under pressure and increased grant funding is unlikely given the current economic situation and grant trends. Thus, alternative approaches and efficiencies with in the current fiscal framework must be considered.

The fact that officials at three metros were not familiar with NGOs and CBOs working in the urban sanitation space suggests that either there are very few such organisations, or that the metro officials have little or no engagement with them. This was supported by interviews with civil society, which found that the state and civil society have very different conceptions around participation, with civil society organisations advocating for co-production and decision-making power in the process. NGOs noted difficulty in getting officials and their service providers to accept alternative and innovative ways of doing things. There is evidence of an atmosphere of mistrust between communities and civil society on the

one hand, and city officials on the other. Whereas municipal officials cite the lack of capacity (in terms of technically qualified staff) as being a constraint, civil society views the issue more as a problem of inadequate facilitation skills and an incorrect approach to the process.

The technology assessment found that the metros surveyed are implementing a range of options from VIP latrines to individual waterborne sanitation. There is no clear ideal technology: all have advantages and disadvantages in different circumstances. There is also no consensus on what sanitation technology option would be considered of acceptable standard. However, the financial modelling results indicate that there is substantial financial incentive to change the prevailing use of lower service technologies for sanitation provision in informal settlements. Chemical (or even bucket) toilets are motivated on the basis that they are an effective short-term emergency solution in temporary settlements. Nonetheless, evidence suggests that chemical toilets are in reality seldom temporary and often remain in place for many years. In addition, the notion of informal settlements being temporary has been called into question.

The analysis has shown that waterborne sanitation is a cost-effective technology solution. It is acknowledged that the high-density and random layouts typical of these settlements can be challenging, but with some degree of reblocking and moving a limited number of households this is generally possible[14]. If a waterborne connection to each dwelling is not possible due to density and layout considerations, a communal solution could be employed. In implementing such approaches there is a need for human settlement planners to take the lead on in situ upgrading in conjunction with the technical planning team from water and sanitation.

The cumulative long-term financial costs of providing low-flush waterborne sanitation technologies in informal settlements, coupled with the improved level of service offering, provide compelling motivation for the technology to be designated the primary choice for service in all settlements except for those in hazardous locations. This could be provided as a communal waterborne solution in the short to medium term, but will require a different approach to community engagement and participation that facilitates settlement reblocking and de-densification where necessary.

Sanitation interventions in informal settlements are usually implemented by a technical department (water and sanitation) within a municipality. This basic servicing is not considered part of the housing or human settlements programme as it is not associated with a housing project or HSDG grant. From the research, it is evident that the shift in mindset from informal settlements being temporary to being permanent and being part of a human settlement continuum needs to be made by those responsible for servicing.

The recognition of informal settlements as permanent sites for infrastructural upgrading has been advocated under national housing policy for over a decade through the BNG: Comprehensive Plan for the Development of Sustainable Human Settlements, which stated “informal settlements must urgently be integrated into the broader urban fabric to overcome spatial, social and economic exclusion … through in situ upgrading in desired locations” (NDHS, 2004:12).This strategy has been further renewed in the Draft White Paper on Human Settlements (NDHS, 2015) and in the IUDF (DCoG, 2016).

Sanitation provision should be considered a first step in human settlement formalisation processes. This requires a greater level of commitment to in situ upgrading and an increase in capacity to plan, implement projects and manage these settlements together with communities.

[14] This was done, for example, in the 10 000 household in situ upgrading of the Soweto-on-Sea informal settlement in Port Elizabeth in the early 1990s and in Langrug, Western Cape in 2013.

6 POLICY RECOMMENDATIONS

Internally prioritise municipal funding for sanitation

The financing of sanitation under the current fiscal framework is largely an outcome of budgetary prioritisation processes between services at the municipal level. It may be possible to increase the available quantum of funding for sanitation by reprioritising funds away from other services and towards sanitation. While this is likely to be met with internal resistance and will be difficult to negotiate, it could be achieved by prioritising sanitation politically. Officials responsible for sanitation provision should lobby municipal councillors in this regard.

Revisit sanitation tariffs to increase revenue generation

Raising tariffs is another means to adequately cover operational costs and provide for capital expenditure, and critically, the renewal of existing assets. Although the ability of municipalities to raise tariffs was not assessed in this project, this approach must consider the overall affordability of the basket of municipal services for a range of customers. The collection of revenue from all non-indigent households who are receiving formal services is another obvious intervention that municipalities can and should make.

Engage communities around settlement options

The proposed approach requires considerable engagement and negotiation between residents and the municipality – far more than is being done at present. Strengthening of participatory governance and building the institutional capacity for government to engage are short-term priorities of the IUDF under Policy Lever 7 (DCoG, 2016) and form part of Position 1 of the new National Sanitation Policy.

Allocate adequate resources to engagement and participation

It is important that this process be allocated the attention and resources that it requires, as it may ultimately dictate the success of the future of the settlement. It should not simply be seen as a technical exercise in providing emergency basic services where there are currently none.

Build capacity in the sector

In line with the National Sanitation Policy Positions 18 and 20, capacity should be built among all stakeholders in the sector. Where CBOs are unable to fill the current operational vacuum as intermediaries to facilitate a true participatory upgrading process, it is better to establish in-house municipal capacity as it should be the ultimate objective that this function can be undertaken by the municipality themselves in the long term.

Determine the permanence of a settlement at the outset

Determine whether the residents are in imminent danger and relocation is required. This would imply that a temporary sanitation solution is appropriate.

Initiate sanitation as the first stage in a comprehensive formalisation process

This is likely to require some degree of reblocking in all but the least dense of settlements.

Select appropriate technologies for the long term

Where a settlement is not identified for relocation, the most appropriate sanitation technology should be selected (from a social, technical and long-term financial cost perspective) and its implementation

planned with a formalised end state in mind. This in line with the position in the National Sanitation Policy position that states, “services should be provided with a progressive plan that addresses land tenure and basic services” (Position 1).

Provide low-flush sewered waterborne sanitation in all but extreme situations

Assuming that the towns and cities of South Africa are all provided with an existing waterborne sanitation system serving the majority of people and recognising that the costs of waterborne sanitation are not prohibitive, low-flush sewered options should be taken as the standard option for sanitation in informal settlements. Even if this is implemented in the form of a CAB initially, the layout should be designed for possible connection from individual households. Decentralised sanitation solutions could be considered at sites were bulk sewer network capacity is limited.

Consider the full water value chain in assessing the resource demand of sanitation interventions

The decision to implement waterborne sanitation solutions needs to engage with the full value chain of water supply and consider the resource, bulk treatment and distribution, and the reticulation of the supply. In the case of sanitation, the national imperative to conserve water needs to be weighed up with the inequity of providing differing levels of service for different urban residents. If providing waterborne sanitation in informal settlements results in a 5% additional water demand, is there opportunity for achieving savings of 5% from users who already have waterborne sanitation and use potable water for other uses (gardens, swimming pools, etc.)?

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ANNEXURE A: STAKEHOLDER ENGAGEMENT

Table 20: Municipal engagements

Organisation	Name	Position
Ekurhuleni Metropolitan Municipality	Philemon Mashoko	Head of Department Water and Sanitation
	Dimakatso Zamisa	Deputy Head Finance
	Thokozani Maseko	Operations and Maintenance
	Kennedy Chihota	Design
eThekwini Metropolitan Municipality	Ednick Msweli	Head of Department: Water and Sanitation
	Sibusiso Vilane	Deputy Head: Sanitation Operations
	Bhavna Soni	Deputy Head: Planning and Design
	Dave Larkin	Senior Manager: Design
	Dave Wilson	Senior Manager: Waste water Network Branch
	Rosh Maharaj	Senior Manager: Finance
CoJ	Nomvula Mafokeng	Deputy Director: Water Services Regulation and Policy Development
	Enoc Mudau (Johannesburg Water)	Senior Manager: Basic Sanitation Provision
	Johan Koekemoer (Johannesburg Water)	Director: Finance
City of Tshwane	Eghardt Victor	Director: Sanitation Design and Technical
	Frans Mouton	Deputy Director: Sanitation Design and Technical
	Frans Pieterson	Regional Director

Table 21: Engagements to obtain residents perspective

Name	Organisation and Position
Residents in informal settlement in eThekwini	Janitors and members of the local community structures
Dan Smither	Key of Hope – Executive Director
Juliet Waterkyn	Africa Ahead
Sizwe Mxobo	SDI Alliance/CORC – National Project Coordinator
Axolile Notyala	SJC – Head Local Government Programme

1. eThekwini interview notes

This section of the document has been used to capture interviews held in eThekwini municipality on 23 and 24 November 2015.

Ednick Msweli

Ednick is the Head: EWS who is responsible for the water and sanitation services in the municipality. The water and sanitation unit currently has 3300 employees.

Institutional

Water and sanitation are ring-fenced as individual entities. Thus, each service is required to balance the expenditure to revenue received. EWS is guided by the human settlement department on the housing programme. Thus, EWS is required to liaise with human settlements on a regular basis and ensure that the bulk sanitation network plans are aligned to the housing programmes.

There is no problem with the institutional arrangements and governance associated with the provision of sanitation services in urban areas. However, challenges have been noted when houses are developed in areas where there are no bulk services.

Water and sanitation is inextricably linked. Therefore, the cost of the bulk water tariff also has a cost of the sanitation service. eThekwini receives bulk water from Umgeni Water (Water Board) that charges the municipality a bulk tariff, which impacts on the cost that the municipality has to recover from residents.

Finance

The capital funding received by the municipality is insufficient to reduce the backlogs and renew infrastructure. Currently, approximately R300 million is required annually to renew assets. This is based on the assumption of spending 2% of the current asset value on renewal to ensure that the entire asset base can be renewed over a period of 50 years.

The municipality has also identified that R2.2 billion in capital expenditure is required to eradicate the water and sanitation backlog over an eight-year period. However, only R50 million of grant funding has been made available annually.

The sanitation operational budget has a deficit of R100 million due to the approved tariffs being lower than the required tariffs to ensure a funded budget. Often tariff approval is based on political considerations. The shortfall in the operational budget will be financed from property rates.

Technology

CABs are a good interim services arrangement, but these do come at a cost. Currently, R110 million is required annually to operate and maintain the 1100 units that the municipality has installed. However, the installation of CABs must be linked to a longer-term intervention as this is an interim solution.

CABs should also be paired with a janitor service to ensure that facilities are well maintained, and faults are reported. The caretakers appointed are selected from the settlements on a rotational basis.

Chemical toilets are not seen as a viable interim solution as these are not provided with showers and have relatively higher operational costs than other technology solutions.

Land

The municipality has decided to provide households in rural areas with urine diversion toilets. However, the municipality has noted that there has been an increase of middle- to high-income households in these areas. The result is that there is an increase in water demand and waterborne sanitation. There are two challenges associated with this:

- Households that are located on trust land.
- Access to bulk infrastructure.

The municipality is exploring ways in which households reflected on trust land can be charged for the services consumed. This has proven to be difficult as these households do not have formalised addresses and it is difficult to deliver the municipal bill. Households that do not have access to bulk infrastructure may have septic tanks, but these are dependent on space and other technical requirements.

The municipality has also implemented a system where water and sanitation accounts can only be opened in the name of the property owner. The owner is therefore responsible for the municipal bill and not the tenant.

Community

People ultimately want flushing toilets but there is a cost and water availability implication. The municipality has recently had to introduce water restrictions, and these speak to the decreasing availability of water.

User acceptance will be a challenge with any technology other than waterborne sanitation. This can be overcome with community engagement and education, but this can take several years. However, this time can be reduced if lessons learnt from the past can be shared and implemented.

The construction department within EWS leads the community engagement process. This begins with the discussion of the ward councillor and then local community-based structures. Community liaison officers are appointed and tasked with informing residents about the level of service.

Certain communities do not want urine diversion toilets but rather full waterborne sanitation. However, in instances where the expectations of the community cannot be met, they have to be managed. This is an important part of the community engagement process to ensure that infrastructure is used correctly and not damaged. There have been small instances where infrastructure is abused, such as the removal of doors, etc. but a large portion of the technologies provided are in a good condition.

User education is no longer as intense as it was in the past. This can be attributed to more people being aware of facilities should be used as residents become more familiar with technologies.

Other

EWS has an ageing workforce with scarce skills that are required to design, operate and maintain infrastructure. However, many of the skilled staff have retired or will retire soon. EWS has introduced and internal mentoring and coaching programme to ensure the transfer of skills and development of younger staff.

Sibusiso Vilane

Sibusiso is the Deputy Head: Sanitation Operations at EWS who is responsible for the following branches:

- Waste Water Networks Branch.
- Mechanical and Electrical Branch.
- Waste Water Treatment Works Branch.

His role is to coordinate and manage the different functions of these branches to provide a quality sanitation service to the residents of the municipality.

Institutional

Providing sanitation is closely linked to the housing programme. However, the coordination between the water and sanitation unit and human settlements has not been strong in the past. However, an interdepartmental committee has been established to improve the communication, planning and coordination between these two departments.

There are occasions in which the location of housing projects is influenced by political reasons. These sites may lack the access to a bulk sewer connection or waste water treatment works capacity. There needs to be a clear definition of how projects are approved and communicated to ensure that houses that do not have access to services are not developed.

A lack of management systems within department has been identified. These include:

- Standardised operating procedures.
- Business process mapping.
- Quality control systems.
- Risk management.
- Data management and documentation.

The need to reduce the reliance on contractors has also been identified. For example, EWS has staff employed as electrical and mechanical artisans, but rely on external service providers to complete a large portion of the mechanical and electrical work.

Finance

The expenditure on capital infrastructure is largely driven by the level of service that is provided. However, the grant funding allocation is not being determined by the backlogs or any other quantifiable measure. The Rural Households Infrastructure Grant could be used for providing sanitation infrastructure for poor households, but this money is with DWS and is currently not being spent.

Technology

Urine diversion toilets are provided as an acceptable level of service. This is considered to be above the minimum level of service (VIP latrines) and is usually provided in rural areas. CABs are provided in informal settlements as an interim level of service. Decentralised waste water treatment works are also being considered as an option.

The municipality has a vast network of sanitation infrastructure. Ageing infrastructure is a challenge that has been identified. This can result in increased spillages and a decrease in the quality of service that is provided. Operational and maintenance costs can be expected to increase as the age of infrastructure

increases. Linked to this is that there is insufficient information on the condition of all sanitation assets. This further increases the risk of a decline in sanitation services provided.

Community

EWS has an effective customer services and liaison department that is well resourced to engage with the community. The team liaises well with councillors and community-based leadership structures. It is noted that everyone would prefer in-house waterborne sanitation, but alternative technologies can also be implemented if communities are engaged correctly and the reasons for the alternative technology are explained.

Other

It is important to ensure that staff with the correct skills and experience are appointed to positions. Currently, a mechanical engineer is required to oversee the work of mechanical and electrical artisans. Mechanical and electrical work are specialised skills that have an impact in the quality of the sanitation service provided. Thus, the department has taken a decision to move towards appointing electrical engineers for electrical work and mechanical engineers for mechanical work.

Bhavna Soni

Bhavna is the deputy head responsible for strategic planning, design (water and sanitation), business and commerce, geographic information system (GIS) and asset management with approximately 300 employees.

Institutional

Internally, CABs are managed by a project executive. EWS is also piloting several different technologies at waste water treatment works to improve the business. EWS is exploring different contracting alternatives regarding sanitation. These include the feasibility of a franchisee/franchisor model for CABs, and the viability of establishing a PPP to build, operate and maintain a regional waste water treatment works. The regionalisation of the waste water treatment works could result in a more efficient service at a lower cost.

The human settlements department is a key stakeholder within the municipality. A housing committee has been established to ensure that bulk sanitation network is available for proposed housing developments. The committee includes human settlements and the associated service providers. The human settlements department has to obtain clearance certificates from EWS to certify that bulk networks are available prior to rolling out housing projects. The need to liaise and engage with the housing committee has been included in employee's performance management contracts.

Housing is responsible for providing reticulation services within a housing development. The reticulation is transferred to EWS once the housing development is completed in order to be maintained. EWS must ensure that the reticulation network meets with their design and construction standards and that the as-built drawings are accurate.

eThekwini Municipality also has an infrastructure committee that is located at a cluster level. This committee is informed of the projects and provides oversight of projects at a municipal level. Funding for housing projects is only released once the service certificates have been issued in order to confirm that services are or can be made available.

The strategic planning department is responsible for determining the level of service that will be provided in different areas. This is based on the long-term water services development plan, policy and availability of bulk sanitation infrastructure and capacity

Technology

EWS are currently piloting several new technologies at waste water treatment works.

Land

Sanitation services cannot be provided on privately owned land. Thus, privately owned land has to be purchased, expropriated or services placed on municipal owned land close to the settlement.

There is also an issue associated with land that is held by a trust. Traditionally, these were considered to be rural areas, but there has been an increase in the development of middle- and high-income households in these areas. Thus, community liaison officers are required to engage with the chief in these areas to obtain permission to install services on these sites. The collection of revenue from these areas are also a challenge.

Other

The roll-out of CABs has also increased the number of illegal water connections and thereby the increase in non-revenue water. Residents connect to the water connection to the ablution blocks once installed, which is difficult to monitor.

A further challenge is the rapid growth of informal settlements. The municipality targets one set of ablution blocks for 70 families but due to the rapid growth, the number of ablution blocks per settlement has to be increased.

Misuse of the infrastructure, vandalism and theft are also difficult to manage and drive the operational costs of the municipality upwards while reducing the quality of service that is provided.

Dave Larkin

Dave is the design manager at EWS. The design branch is responsible for providing the bulk sewer network. The team has limited involvement in the provision of the reticulation network as this is done by the housing department and private developers. The design branch team includes area engineers and technicians. Traditionally, the branch has employed mainly civil engineers but there has a drive to include mechanical, electrical and chemical engineers within the team.

The design team is considering new methods in the handling of the urban sanitation challenge. This has included the restructuring of the unit. Waterborne sanitation is an expensive solution that cannot be rolled out to all households due to the lack of water available.

The municipality has tried several different technologies. Some have been more successful than others. The municipality is currently doing a trial on the Decentralised Waste Water Treatment System while also looking at alternative technologies in the waste water treatment works.

Institutional

There are a number of committees that have been established to coordinate greenfield housing developments as well as upgrading on-site. For example, the development units in engineering will

conduct a feasibility study and coordinate projects with the infrastructure departments. The municipality also engages with the industry and large housing developers.

Finance

Table 22 describes the funding sources utilised by the municipality.

Table 22: Funding sources

Funding type	Funding source
Capital	• Loan funding. • Transfers from National Treasury (such as USDG).
Operating	• Operating transfer from National Treasury (such as the Equitable Share). • International grants (although these have a high administrative burden).

The municipality has also used PPPs in the past and are planning to introduce other PPPs at selected waste water treatment works. However, it has been noted that the privatisation of waste water treatment works has not been successful internationally.

The barrier to finance is the capacity to spend the money rather than shortfalls in accessing finances. The design team works on projects and project delivery is therefore limited to the number of employees that have the capacity to fulfil the different roles required within a project team. Limiting factors include, time to check the project documents, project management and administrative requirements.

Technology

Table 23: Experience with different technologies

Technology	Experience
Chemical toilets	• These are mainly used on construction sites. • These toilets usually have odours and prove problematic when discharging at the waste water treatment works.
CABs	• CABs are a temporary initiative when the informal settlement is not on short- or medium-term housing plan. • The CABs have evolved into community centres. • The department has noted an increase in water losses.

CABs require bulk infrastructure and not all settlements can be readily connected to the bulk sewer network. Space and the mobility of households in the informal settlements are also a challenge. There have been examples of households who were erected on water and sewer pipes that have been laid.

The operation and maintenance of waste water treatment works is an area in which municipalities could possibly achieve significant savings while maintaining the required level of service. Savings could be achieved by ensuring:

- Process efficiency.
- Energy efficiency.
- Maintenance efficiency.
- Pumping efficiency.

Land

Accessing land is an issue when the land is not owned by the municipality. The municipality must check the details of the landowner and thereafter negotiate the purchase price of the land. The selling price of the property is based on the consensus value of the land. If consensus is not reached, then the council moves to expropriations. The municipality does not provide services on privately owned land.

Other

EWS has used a bursary scheme that has enabled university graduates to be mentored by skilled experienced staff. Part of the process includes selecting people who have the right skills and who also fit into the team culture. EWS has also used the ISDG grants from National Treasury. This has enabled the employment of 34 graduates (various engineering backgrounds) on five-year contracts who are trained to the point of being professional engineers.

The lack of skilled staff within the organisation remains a challenge. EWS has had many senior engineers and managers retire within the past few years and these skills take time to replace. There are also challenges faced when non-technical staff make technical decisions. This can result in major challenges. Political interference in the decision-making process and projects also causes problems as this sometimes causes project delays and increases project costs.

Dave Wilson

Dave Wilson is the senior manager (acting) of the waste water network branch. This branch is responsible for the operation and maintenance of the total municipal sewer network. Essentially, this department transfers the waste water from households to the waste water treatment works.

The waste water networks branch comprises approximately 500 employees and includes approximately 8000 km of sewer reticulation network, 700 km of trunk sewers and 270 pump stations. The department also uses contractors.

The waste water networks branch is separated into four geographic areas and one satellite area. Each area has an area engineer who is responsible for the area. Reactive maintenance is conducted based on the public logging calls with the call centre. A job is logged, and the relevant crew is dispatched to resolve the issue.

Institutional

The mechanical and electrical team within EWS provides a crucial support function to the waste water networks department. The need to establish a committee who is tasked with liaising with the human settlements department has been identified. The waste water networks department will be scheduling regular meetings to ensure that the housing programme and sanitation bulk infrastructure delivery programme are aligned. This committee will also include other role players from within the department.

Technology

EWS is currently piloting technologies for VIP and urine diversion sludge (as listed in Table 24). Urine diversion toilets is the selected service level for rural households.

Table 24: Technologies piloted by eThekwini

Technology	Description
LaDePa	This is a containerised solution that can convert pit latrine sludge into a usable, pasteurized, dry product that is beneficial for all agricultural use.
Black soldier process	Black soldier fly larvae consume urine diversion sludge and are sold thereafter as animal feed.
Pour-flush toilets	These have been on trial in Pietermaritzburg. They can be located within the dwelling unit. These toilets are considered to be on-site dry sanitation as the toilet uses a litre of water per flush, which drains into a 1 m^3 leach pit.

Table 25 details the experience that the municipality has had with different technology choices.

Table 25: eThekwini's experience with different technology

Technology	Experience
Low-flush toilets	• Clean and no odour. • Uses less volume of water per flush than a conventional toilet but the capital cost is the same as conventional toilets. • Operational and maintenance costs tend to be higher than conventional toilets as the low flushing velocity results in a higher number of blockages.
Dry toilets	• Limited advantages but does eradicate open defecation. • Capital cost – R12 000 per unit. • Operating cost is R1000 per unit every five years. These toilets are designed to be cleaned once every five years for a family of five people.
Urine diversion toilets	• These toilets do generate odours and are dark. • This is an acceptable level of service.
Chemical toilets	• Used in exceptional circumstance only for relatively short durations. • The operational and maintenance cost is R490 per toilet per week.
CABs	• These are only installed in informal settlements as an interim solution. • These are constructed at a target of one set (male and female) per 70 families. • There is an option to install solar panels to prevent illegal connections to the lights around the ablution blocks. • Complaints have been received about safety in accessing the facilities at night. • The units are usually established with an access to households within 200 m, but residents have also complained about the distance to walk from the households. • These units have a very high water consumption (approximately 50 kl per day).

The municipality is considering the option of a franchisee/franchisor model for CABs. This has the benefit of creating jobs and businesses within the settlement.

One of the issues associated with package plants is that they require power. This opens the units up for abuse through illegal connections unless all dwelling units within the area have access to electricity.

Land

The municipality engages with the owners of land on which informal settlements are located to negotiate a suitable purchase price. This is usually managed by the human settlements department within the municipality. The willing buyer–willing seller principle applies.

A sewer connection is provided to every erf in urban areas. In the case of backyard dwellers, the onus will then remain on the landowner to provide reticulation services within the lot.

Community

There are ward and community structures that are used to engage with communities. However, this process does sometimes lend it itself to power struggles. The municipality has noted different responses to different technologies that have been implemented. Generally, there are problems with any technologies that are not located within a home.

Community responses have also changed over time. For example, the municipality initially only planned on cleaning VIP latrines and not urine diversion toilets. Residents who received urine diversion toilets were initially happy with this arrangement, but have requested that the municipality also clean the urine diversion toilets. Thus, the municipality has begun clearing urine diversion sludge as well.

Other

The municipality is increasing the extent and coverage of sanitation services on an annual basis. However, there are limitations on the number of new staff that can be appointed. Thus, existing staff are expected to take the additional responsibility of maintain the ever-increasing network.

Theft and vandalism of the sewer network is also a concern. The municipality has also noted an increase in mining of the sewer network. This is a practice whereby the flow through the sewer network is diverted by breaking the line or through some other means that enable miners to sift through the network for jewellery, money and other valuables. This is an unsafe practice that can result in serious injury or death of miners.

There are areas within the municipality that have displayed levels of violence towards municipal officials in the past, and high levels of crime. Municipal staff are sometimes unwilling to venture into these areas and this provides a further challenge.

Rosh Maharaj

Context

Rosh Maharaj is the Manager: Finance at EWS. He provides financial oversight on the capital and operating budget. The finance team at EWS comprises 40 staff with roles such as accountants, management accountants and senior clerks.

Institutional

The EWS finance team submits monthly reports to the eThekwini Corporate Finance team. The Corporate Finance team is responsible for the section 71 (MFMA) reports that are submitted to the National Treasury. The EWS finance team also prepares monthly financial reports that are presented to senior management.

The eThekwini Corporate Finance team reviews the budget and tariffs proposed by the EWS finance team. The chief financial officer (CFO) of the municipality ultimately decides on the percentage tariff increase and grant funding that will be received by EWS. EWS then has to adjust the budget and tariffs accordingly.

The Corporate Finance team is also responsible for taking out loans on behalf of eThekwini Municipality. These loans are then apportioned internally. The EWS team does, however, consider opportunities for international grant and donor funding. These opportunities include the IPSA grant and often have conditions attached.

EWS has established a multi-disciplinary project committee to ensure that all internal stakeholders are aware of projects, costs and project implications. The project committee has also been tasked with providing project oversight.

Finance

The eThekwini Municipality received the USDG from National Treasury. The portion of the grant that is to be transferred to EWS is determined by the CFO. The allocation is determined based on the capital projects that will be funded by USDG. The costs associated with providing free basic water and sanitation services that are used in the allocation calculation is provided to corporate by the EWS finance team.

Capital funding for CABs are provided for from the USDG. However, the financing of operational costs is proving to be a challenge. EWS has decided that funding for CABs should not be provided from cross-subsidisation from other sanitation customers but should rather be funded by rates revenue. EWS is considering the introduction of a monthly basic charge for services. Fixed charges were used in the past, but these were problematic to calculate and were subsequently removed for residential customers.

EWS does not recover development charges. However, there has been instances where developers have developed municipal infrastructure for a development to proceed, and has then transferred the infrastructure to the municipality for operation and maintenance.

Technology

EWS produce approximately 200 additional CABs a year. There are currently about 1100 CABS installed across eThekwini Municipality. The operating budget to operate and maintain CABs is approximately R120 million a year. This can be expected to increase as more units are installed. Therefore, the municipality is considering the use of a franchisee/franchisor model. The franchisee/ franchisor model is also able to create businesses and jobs at a settlement level. This model could result in improved policing and reduce vandalism and water losses.

The installation of CABs has also increased non-revenue water, while maintenance of the ablution blocks is also very high. The increase in non-revenue water can be attributed to illegal connections to the water supply of the CABs as well as user behaviour (people using more water than is required).

Land

On the issue of backyard dwellers, EWS will provide a waterborne sewer connection in a formal area. However, the municipal account will be submitted to the owner of the property. The owner is responsible for the payment of the municipal bill. The same principle applies to tenants who rent homes or flats.

eThekwini Municipality has noticed an increase in the demand for services in areas that were previously considered rural areas. Consumers are starting to demand a higher level of service, but these houses

are on trust land and therefore have no formal address where municipal bills can be delivered. EWS has developed a strategy that includes the capturing of the resident's information on GIS and engaging with the chief of the land to ensure that municipal bills can be delivered to consumers.

The human settlements department is responsible for financing water reticulation infrastructure within a housing development. However, once the site is completed, the costs and budget are transferred to EWS. This may be difficult to implement in the proposed municipal standard charter of accounts (mSCOA) process.

Other

The implementation of national policies has funding implications and it is important for policymakers to note these costs prior to policy implementation. For example, water use licences require the annual monitoring of groundwater at each waste water treatment works. The cost of this at each waste water treatment works will be in excess of R1 million annually. EWS has 27 waste water treatment works.

The implementation of mSCOA will also be very challenging to implement. mSCOA is expected to be implemented in June 2016 and will be a challenge that needs to be managed.

Community liaison

Site visits were conducted at the Boxwood and Parkington Informal Settlements in Durban. The visit was led by Mr Lucky Sibiya (Manager: Community Liaison). The CABs were initially inherited from the city health department within eThekwini Municipality and were originally constructed with blocks. Residents have mentioned that the introduction of the CABs has had a positive impact on their lives as they no longer needed to walk long distances to collect water and there has been a reduction in open defecation.

The CAB service includes a janitor service. The janitor works four hours per day, which can be split over the course of the day. It is preferable to source a janitor who lives relatively close to the facility as this will assist with control and protect against vandalism. However, the challenge around vandalism was highlighted by Siphiwe Qwala, who stated that it is difficult to confront residents from the informal settlement who installed illegal electrical connections to the lights around the CAB, as they could become aggressive.

Janitors are selected based on an engagement with community following which decisions are made. Each janitor is paid a stipend, which is funded by the EPWP. The community engagement process also determines the times at which the facility will be opened and closed. Some communities prefer to have access to the facilities at all times while others find it preferable to close at 22:00 and reopen at 04:00.

eThekwini Municipality also supplies toilet paper to the facilities. However, the municipality has experienced challenges with the procurement process for these supplies, which has resulted in an increase in blockages as residents have used newspapers as a replacement.

High water demand

Possible challenges associated with the CABs is the wastage of water. Residents leave the taps open while washing clothes, which increases the volumes of water used. Leaking taps and fittings also result in increased volumes of water being consumed. The municipality has a system in place: the call centre is contacted to report leaks and any other deficiencies that may occur. However, this is sometimes slow and leads to water being lost. Possible amendments to the system can include adding JoJo tanks that could be used to store rainwater that could then be used to flush toilets. This system could be operated as an alternative to the potable water system, which will reduce potable water demand.

Local community structure

eThekwini Municipality engages with residents when determining the installation and operation of CABs. This is done via the local community committee. This committee is selected by residents themselves but has a representative who also serve on the ward council. Thus, the committee is involved with issues beyond just sanitation. The committees are the point of contact for the municipality when the decision to install a CAB is taken. The committee engages with the municipality, discusses the options with the community, and then gives feedback to the municipality.

The local community structure makes decisions regarding the location and use of CABs. For example, some CABs are left open 24 hours a day and can be used at any time while others are closed at 22:00 and are opened at 04:00 to reduce vandalism and improve safety. The local community structures are also involved with selecting a janitor and assisting in reporting unresolved complaints to the ward committee.

Janitors

The use of janitors has proven to be very successful in the operation of CABs. However, there are emerging challenges associated with the janitor programme. Firstly, the janitors are currently funded through the EPWP and receive a stipend to carry out their duties. The EPWP requires employees to be rotated once every two years to provide access to employment opportunities for as many people as possible. This causes a challenge as janitors become dependent on the stipend and are reluctant to hand over the responsibility to a newer member of the community.

A further challenge that has emerged is that municipal worker unions are advocating for janitors to be granted the same conditions of service as municipal workers. This includes a minimum salary, full leave allocation and pension benefits. The municipality is concerned as the city currently has in excess of a thousand CABs and the current budget does not include the full-time employment of the janitors currently funded through the EPWP.

Vandalism

The issue of vandalism of CABs is difficult to manage. Good lighting must be provided around the CABs to create a safe environment. However, this provides an easy access point for electricity theft. The same holds true for illegal connections to the water mains connecting to the CABs. This can also contribute to increased water and electricity losses.

Janitors are sometimes able to identify the perpetrators due to their proximity to the CABs, but they are sometimes fearful to do so due to their own safety concerns. The result is that connections are simply replaced once the municipality has attempted to remove any illegal connections. Also, some illegal connections result in unsafe conditions for residents living in the informal settlements.

2. Tshwane interview notes

Eghardt Victor and Frans Mouton

Frans is the director responsible for the design and technical division of the sanitation branch of Tshwane water and sanitation while Eghardt is the deputy director within the same division.

Context

Tshwane water and sanitation has undergone an organisational restructuring in 2015. This new structure is still settling in and there are teething problems. The interviewees are hesitant to commit to whether the new structure is more efficient, but it seems promising.

The sanitation situation in the municipality is that there is a significant backlog. A backlog is defined as an unimproved pit latrine. There are no bucket toilets. There is not a significant amount of backyard dwellings. The main contextual challenge is that the design capacity of the network has almost been reached, and there is therefore a need for more bulk capacity due to both densification and sprawl.

Institutional

Tshwane has a single department for water and sanitation. It is split into two branches, namely, water and sanitation. Within sanitation there are three subdivisions, namely, planning and design, infrastructure provision, as well as seven operational regions.

Another major role-player in providing sanitation is the housing department. The housing department is more involved in the formalisation process, whereas Tshwane water and sanitation is more involved with formal households and expansion, as well as providing the network after the formalisation process is complete. During the formalisation of informal settlements, the housing department provides chemical toilets as an interim solution before providing waterborne sanitation once formalised.

There are seven regions across the city. These regions are responsible for the operations and maintenance of the network within their jurisdiction.

There are significant communication challenges with the housing department. Housing drives the provision of services and is incorporated in the master plan of Tshwane water and sanitation, but housing does sometimes change their plans to develop other areas, which is then challenging for the sanitation division. There are no forums in place to make this any easier.

Rand Water has been appointed as an implementation agent of urine diversion systems in areas outside the urban edge.

Finance

The regions are self-funded and must operate from tariff revenue collected. The capital infrastructure provision is done through the infrastructure provision division. This is funded from own loans and USDG. The housing department does provide some assistance towards the bulk network, and in some cases from provincial funding.

Old figures are provided in Table 26 with costs for different sanitation systems (2005).

Table 26: Capital and operating costs for different systems

Technology	Capital cost per site per year	Operating cost per site per year
Chemical toilet	Unknown	Unknown
Urine division systems	R4 528	R0 (after 10 years, there has not been a single toilet emptied by the municipality)
Full waterborne sanitation (1000 m^2 erf)	R13 347	R270

There have been no urine diversion systems installed in the urban areas due to space requirements, the political dissatisfaction with the urine diversion system and community rejection of the system. Urine diversion systems could be funded from the operating budget, as capital expenditure is not allowed on private property. Chemical toilets are provided as an interim solution before full waterborne sanitation is provided.

The city is constantly approached to pilot new or different technologies, but they are unwilling to participate as the risk if failure is too great, which would not be a good situation to be in. The biggest challenges that are experienced from a financial perspective are:

- The lack of ability to implement due to procurement processes.
- Poor workmanship due to inadequate ability of contractors.
- Not enough capital finance. Budget has been reduced due to lack of expenditure due to procurement challenges and not lack of need.

There are processes in place within supply chain management to put better systems in place to improve the process and ensure to appointment of better contractors.

Technology

There are three levels of service which are available, shown in Table 27:

Table 27: Levels of service

Technology	Advantages	Disadvantages
Chemical toilet	• Quickly and easily installed. • Very little water required. • Hygienic when maintained correctly.	• Relatively high capital and maintenance cost. • Desludging required. • Requires educated use. • Community sees it as a lower level of service. • Politically unsatisfactory.
Urine division systems	• Low cost. • Relatively odourless. • Acceptable health standard. • Easy access to the vault. • Can be emptied by the owner.	• Cannot accommodate domestic waste water. • Toilet must be outside. • Needs constant attention and high level of commitment. • Urine is handled separately. • Community sees it as a lower level of service. • Politically unsatisfactory.
Full waterborne sanitation	• Convenient. • Hygienic and odourless. • Toilet can be situated indoors. • Permanent. • More cost-effective in dense areas. • Minimises all risks of ground and surface pollution. • Satisfies aspirations of communities.	• Very expensive to install and operate. • Treatment works required. • Requires large quantities of water.

Land

There is no waterborne sanitation provided to informal areas; therefore, there is no need to register servitudes. The largest challenges when it comes to land is for the formalisation process by the housing department. The city uses their own land where possible, and in other cases expropriates land, although this is very time-consuming and expensive. The environmental impact assessment process is time-consuming for this process too.

In the formalisation process, the sanitation branch assists in the process and states where there is a need for servitudes. However, they will generally keep their services to the road reserve wherever possible. In some cases, there is a need for services to be purchased. This happens particularly in the tribal areas in the north of the city.

Community

There are two public participation processes. There are ward participatory processes that occur as part of the IDP process, and there are community liaison officers who ensure the community needs are satisfied as part of the upgrading process.

Frans Pieterson

Frans is the Regional Director for Water and Sanitation, Region 1 in Tshwane. The regions are responsible for the operations and maintenance of infrastructure.

Context

Region 1 is the biggest region by geographic area in Tshwane. There are a variety of contextual issues here including ageing infrastructure, informal settlements and rural areas. There are 47 employees within the sanitation division. Two-thirds of the geographic area are covered by the municipality's own maintenance teams, and one-third by contractors. This one-third includes the rural areas.

The areas serviced by the depots have expanded significantly over the past few years, which has been coupled with a 20% reduction in warm bodies.

The Tshwane sanitation division is mainly involved in maintaining the formal network. The housing department provides chemical toilets as an interim solution. The community does not enjoy the chemical toilets and will only accept full waterborne sanitation. 90% of the work that is performed in the regions include sewer blockages. The remainder is spot repairs, particularly in the older areas where there are older clay pipes.

Institutional

The regions came into being approximately a year ago, thus there has not been extensive change. The operations on the ground still happen, no matter the overhead structure.

The regionalisation process was entered into quickly and there are still problems associated with it. There seems to be an inflated senior management staff because of this. The process did not allow for the growth that is occurring, and particularly the lack of funding that follows growth. The benefit is that colleagues from the different departments interact on a daily basis. This does not solve the planning problems, however, as planning is a centralised function. Fleet management is a centralised function, which is potentially problematic as there are too few vehicles, and maintenance is performed without prior notification.

The maintenance of waste water treatment plants is performed centrally; however, the maintenance of pump stations is a regional function. There are six pump stations in Region 1. The decision-making process is good as there is an extensive pipe replacement programme in place. It includes the jetting of pipes and insertion of a CCTV camera that records cracks and root ingress. The broken pipes are earmarked for replacement. There are many pipes that are 60 or 70 years old.

Finance

The regions have their own budgets. This is for operations only; there is no capital expenditure managed by the regions. Spot fixes are done using the operating budget of the region. Expenditure is projected from the previous year, but the budget is determined centrally.

The budget is created in an untransparent manner. It is not based on anything tangible. Frans recommends that the budgeting decisions should be made by the extent of the infrastructure with a factor that is related to the age of the infrastructure. The current system is politically motivated, although it is not working too badly. There is not enough money to perform preventative maintenance, which results in there being a higher amount of money spent on reactive maintenance. Billing and tariff design is performed centrally.

Technology

This was not really spoken about, but Frans appreciates the simplified approach that is taken by the city with regard to sanitation. There is an operation management system in place, named IBIS, which allocates resources to jobs and issues the billing. It is a sophisticated system that works well.

Land

This was not spoken about as it does not affect operations and maintenance a lot.

Community

There are counters available at the regional headquarters and at depots. There is also a centralised call centre and email addresses managed by the city.

Other

Operations and maintenance does not bring votes, and is therefore low in political appeal and appears expensive to the uninformed. Frans does not think that there is a higher proportion of blockages per capita than other places. The main reasons are due to sand ingress in the northern area, storm water ingress, loot ingress in lower income areas, and pipe blockages due to roots in more affluent areas. More affluent areas have proportionally higher blockages than other areas due to old infrastructure and roots. Frans agrees that the municipality should not attempt to pilot alternative technologies as they are potentially risky.

3. Ekurhuleni interview notes

Phil Mashoko

Context

The department plays the role of WSA and WSP, and plan for sanitation for the Ekurhuleni area as well as the implementation thereof. It further includes doing short-, medium- and long-term planning, and

formulating policies. They are differentiated from a financial point of view and can ascertain the assets of water versus sanitation, but do not go onto the issue of differentiating overheads. In operations they have clear votes as how costs are defined as sanitation or water, which can ascertain the costs incurred at sanitation level. Operations teams are distinct. Tariffs are separate, but overheads are combined.

Not much is different from the previous year: additional toilets, which are mostly chemical, are provided in informal settlements. The municipality is trying to reduce the ratio of users to toilets; the municipal policy is 1:10. In some settlements the ratio is as high as 1:15, so the municipality is trying to reduce the ratio. A policy has been proposed to reduce the ratio to 1:5.

There are approximately 967 staff currently in the department. The department consists of a head of department, director and an operation division head. An informal settlements chief engineer is in charge of informal settlement (newly approved). He manages a team of engineers who deal with water and sanitation within informal settlements. There are still posts that are being filled. The plan is to have customer and stakeholder management under the directorate of support services. The planning division is also dealing with informal settlements and governance, revenue and water quality. Feel separation of the two lower down. Distinct at the operational office level.

Institutional

Human settlements are the custodians of informal settlements; they play a service provider role, but other departments also come in such as roads. They have an interdepartmental task team or forum, which is chaired by human settlements. Any issues related to plans and sanitation gaps are handled by human settlements. These include informal settlements improvement plans, and where needed, more toilets and taps etc.

There is a forum, namely, AURIT, which provides operations rapid response where issues to do with complaints from communities are dealt with. It is chaired by the customer relations department. Operational staff have a forum where they discuss informal settlement issues.

Barriers include human settlements not understanding their role, for example, the issue of information: someone is expected to manage the information systems of informal settlements. Humans settlements do not regard this as their job. Also, there is a shortage of staff: there is no staff for human settlements. A tender has been issued for an ablution block, which has not been awarded. Procurement processes have been a major problem. The supply chain needs to deal with the issues as a municipality to expedite.

There are many barriers in informal settlements, including density, which is a major problem in informal settlements, issue of migration, continuous migration.

People are refusing chemical toilets, which is a major problem. But, technology must be relevant to the conditions of the informal settlement. Land is often encumbered and in floodplains. The department has to be proactive and have a plan for informal settlements, rather than follow the informal settlements. Technology is an issue, particularly on private land where permanent infrastructure cannot be installed.

Finance

USDG is the main source of funding for informal settlements, and funds about 90%. There is some cross-subsidisations with tariffs. One-fifth comes from tariffs. USDG is used for operating as well. Most of the Equitable Share is allocated to free basic water. National Treasury is not satisfied that they are using USDG for operating, which is a barrier to finance. Other issue regarding funding for infrastructure in informal settlements, which is temporary in nature, is that funding is quite limited and come mostly from USDG. About R60 million is required, but only R9 million has been allocated.

Technology

The department mainly use chemical toilets and ablution blocks. VIP latrines and dehydrations have been tried as well, but they did not function well. VIP latrines are sensitive to the ground.

In relation to Ekurhuleni's site conditions, a sanitation facility is defined according to the national definition of a sanitation facility. It has to be safe, odourless, accessible, and able to be cleaned. The site conditions have to be investigated and the technology must be suitable to the settlement conditions. Councillors are used to engage the community to determine the acceptability and density. The department wants to offer a range of options, but there has not been much choice regarding the toilets that are most suitable for the various categories of informal settlement. This includes the type of informal settlement and the impact of migration.

Land

The formal process to purchase land is to negotiate with the landowner, which is a protracted process. Land identification is normally done by human settlements. When human settlements buy land, it is for formal houses and sanitation is already built in. Most suitable land that can be acquired is often prime property and expensive. Thus, the owner may not be willing to release the land for settlement purposes. Furthermore, peri-urban agriculture, dolomitic areas (underground conditions are not suitable), and proximity to economic conditions have to be considered. The assumption has to be made that when people invade land, they want to live there. Tenure and land claims (other than mining) also play a role. There is no traditional land in the area.

Community

The municipality uses councillors and ward committees to engage communities. They organise meetings with councillors and give them the opportunity to pass messages to the community. Community liaison officers go door to door. Water agents go into communities and identify challenges regarding sanitation.

The water and sanitation unit has very limited engagement with NGOs or civic organisations. Engagement is predominantly with political leadership. The department's ability to engage with the community depends on the councillor organisational ability. Sometimes there is a power struggle in communities, which can be interparty or intraparty struggles. The municipality has tried to communicate using radios and newspapers, but does not feel the message gets through.

Other

We have several backyard dwellers. A formal strategy has not been formulated yet. There is some information available, and some audits have been done by human settlements. The biggest challenge is providing sanitation. There is also the issue of skills: people with the necessary skills or education are required. If it is an informal settlement, settlement patterns, land ownership, hydrological configuration of the land, scattered nature of settlements, and densities have to be investigated. There is also the issue of misuse of the facilities provided. Robust systems are required in informal settlements, or else it will not make sense.

On the financial side, finance can be accessed, but ability to use it correctly is a challenge. Technology decisions are made to suit conditions and there is unpredictability of immigration. There is an issue of underliaising, which leads to repair. For example, cisterns and taps are vandalised.

Thokozani Maseko

Thokozani's role is to operate, maintain, and provide emergency services in both formal and informal settlements.

Context

Regarding general operations and maintenance, there are some areas rehabilitation and construction are needed. The municipality has had an increase in informal settlements. It is a growing area, especially in the north-eastern side where land is available. Brick ablution and container ablution are supplied in information settlements. There are two service providers that do evictions and maintain chemical toilets: TCM and the Red Ants. Due to the geological and dolomitic conditions, and mines in the area, most toilets are chemical. Several informal settlements are on private land, which poses a problem as assets cannot be installed on private property.

Institutional

The land issue is a major issue for the municipality. Many mines are closing and leaving people behind. From the formal hostels, people move to informal settlements. There are restrictions to provide a service in an organised manner. Sometimes people use it as a bargaining tool for housing and it becomes politicalised. It is driven by the politics within the area. The municipality can be ready to provide services, but then communities will say they will not accept the services unless a tar road, for instance, is provided. Supply is done on demand; the request can be through the ward councillors, community organisations, and ward committees. People also write petitions to South African National Civic Organisation.

The municipality does not have a dedicated informal settlement structure. There has been a new institutional review, which has provided for an informal settlements unit are posts are being filled. There have been some issues in the transition process, because we are advertising a large number posts.

Skills are adequate: the right skills are employed, but it is a number issue. Not having a dedicated unit has limited the ability to explore other technologies. However, the department is learning from what other cities have done.

Finance

We are adequately provided for to meet council approved norm and standards, though as a city they want to improve their services through an informal settlement improvement plan. Service is as demanded; we do not say we cannot provide because there is no funding. As part of improvement the plan is to explore other technologies. In areas with access to bulk, the city wants to provide waterborne sanitation. We need more capital on that side, hence the dedicated informal unit.

Technology

Choices are made by reviewing whether it is the municipality's own land, investigating geological conditions, dolomitic, accessibility, access to bulk, and consulting with the communities.

Communities will accept chemical toilets, but will want their own. They want to have an ownership space, want ownership service as well, even with communal standpipe, to their own connections. The standard of living inside informal is a different story.

Table 28: Advantages and disadvantages of different technologies

Categorisation	Description	Advantages	Disadvantages	Costs
Conventional flush toilets	Block toilets, cluster of block toilets together.	High level of service.	• High maintenance costs because it is communal and no sense of ownership. • Communities accept them, because they are clean. • Among the preferred. • Clustered toilets, there can be challenges in the evenings.	• Most of them were not constructed new. • Planning R20 million. • Project division for new housing. • High maintenance of the cleaning.
Chemical toilets	We use water affairs guidelines, toilet, with specified dimensions, well ventilated with handwashing facility afterwards.	Does not smell. No flies, so fairly well accepted. Easy to move around. Works well where excavation cannot be done.	• Some people are not willing to share, but the ratio can be too high: 1:10. • Maintenance and accessibility can be an issue. Difficult to access.	• R170 million. • Generally, adequately maintained. • Happy with the services provided by the service providers. • Attend to complaints promptly.
Communal toilets	Container, fitted with waterborne sanitation, with handwashing area and a tap.	It is an improved level of service; want to improve so people can shower there.	• Access at night is an issue. Get burnt in protests. • Can only supply them where there is bulk sanitation. • Access challenges, need a big truck to deliver them.	• Provision by municipality, capital expense. Small scale roll-out, procured a number delay in the supply chain management process. About R20 million was planned. • About R1 million to maintain. • Easy to maintain, because have community agents, who are people employed to maintenance and report failures.

Land

Landowners might agree that they can provide land, or the department negotiates with them and buys the land and provides sanitation.

Community

We engage with communities through a ward councillor; there can be a barrier if there is political instability in the ward, or community bargaining. People want to jump the queue. The mechanisms are used, and the AMIS system is used for tracking. We have a weekly meeting that deals with petitions, and weekly tracking per department.

Other

Backyarders affect operation and maintenance. It has been found that the system is overstretched: it is designed for seven people, not 15–20 per connection. Infrastructure is designed and sourced according to specific conditions. There is high densification and the system is not coping: both in build and distribution aspects. There are established townships, subdivisions and high rises. People have a way of beating the developmental levy.

The history of East Rand is that there are old towns and ageing infrastructure, which is a challenge. The city is inheriting private developments that are not constructed and designed properly, as well as housing from human settlements that does not meet engineering standards.

Dimakatso Zamisa

Context

Dimakatso is responsible for support services, communication and marketing, finance, information and communications technology, as well as human resources.

In terms of informal settlements, we are responsible coordinating information. Most petitions come from informal settlements. First, we need an internal response, and follow up on commitments made. From the budget side, we motivate for additional funding, and motivate as required. But, this has not happened in the past year.

We have started a new project to ensure toilets are serviced twice a week. We are now employing people to verify. Water tankers have a community-based monitor employed and paid.

Suppliers provide chemical toilets and clean them. We are increasing the number of chemical toilets; the ratio was 20 people per toilet. When there is a request for more toilets, the department establishes the number of additional people. Sometimes we get requests for more toilets than they are supposed to have. The department has also increased the number of standpipes and try to supply additional standpipes. There is a significant amount of grey water around the standpipes. Drains with sifting technology have been created to manage the grey water.

There are two structures running in parallel in the department: the current structure is supposed to have 1092 staff, but we have 934 staff. Most vacancies are at general worker level. With the new retirement law being proposed, most older people panicked and resigned at around 55 years old.

The new structure is supposed to employ an additional 91 people, but there is a lot of red tape: job descriptions and job evaluations have to be done. Human resources must advertise the position. The

closing date is October and CVs are awaited. One person has been allocated to shortlist and do interviews for three departments. The same process has to be followed for all vacancies, thus the positions cannot be filled even if the description exists.

Institutional

Currently, there are four staff members within the support services division, which is undergoing change within the metro, such as institutional reviews. There are several vacancies. Ideally, in terms of the structure, there should be three managers, customer care and an executive manager. Also, staff is required for finance, human resources, ICT, and as administrators.

Currently, there are only four people in support services who are responsible for coordinating information. They play a central role on all except for oversight and legal. All other requests are also.

There are informal stakeholder meetings, and meetings with provincial departments once every six months to discuss plans. Department of Education does school visits for planning purposes; these are mostly one-on-one engagements. Rand Water does awareness campaigns on a monthly basis.

Finance

In terms of finance we have:

- Capital expenditure.
- USDG, 2015 have about R359 million.
- Revenue internal only R11.5 million (tariffs and fines).
- External loans R22 million.
- CRR R119 million.
- Operating Expenditure.
- USDG.
- Repairs and maintenance.
- About R3 million from USDG.
- Salaries come from actual revenue.

In terms of capital expenditure, we are currently unable to deliver as there is an issue with water use licences. In the planning stage it is stated that licences are not required. But, then when we get on the ground, they say we need it.

We have an issue with how we budget as a metro. When you budget, you give an estimate. When you advertise, you get told your estimate is a bit low. But, when the estimate is high, the amount has to be justified. The procurement process itself is a barrier. It can take a whole year to get through a tender process. There are capacity issues in Ekurhuleni procurement department.

Changing rules are a barrier, for example, USDG should cover all construction-related costs such as building a toilet. We were told in December that building a toilet is an operating expenditure, not a capital expenditure. However, no additional funding is provided as operating expenditure and we cannot move money. This was the CFO’s decision. It looks like we plan properly, but because we depend on other people, we fail for some reason: fail to appoint a contractor, etc. other people are delayed. We need better cooperation between our departments.

Technology

From the water and sanitation side, VIP latrines are preferred, but because they are expensive, they are difficult to provide. We have containers, chemical toilets, and built toilets. Chemical toilets are given

as a temporary measure, but the public want their own toilets. We get petitions saying that people want toilets in their yards, but it is an informal settlement. Unfortunately, we cannot provide what they want. Cleanliness is an issue. They are happy in some areas, but not others; the timing also matters.

We initiate engagement where we receive petitions and do media queries through journalists. We have service delivery visits, that they do also, the head of department and petitions.

Land

Land issues go through human settlements and real estate departments.

Community

Councillors bring petitions from the communities.

Other

The municipality has no engagement with backyarders. In terms of sanitation, the problem that they have is that the infrastructure is way too old, and needs to be resuscitated. There are not enough reservoirs. They need to build additional reservoirs. The municipality also has a difficulty with Rand Water cutting off pipes.

It is difficult to plan, especially for informal settlements. The municipality assumes that they are there permanently, but they move. You invest in things that will not necessarily be required in a few years. There is an issue of congestion: pipes designed for a specific area with a specific number of people. Suppliers deposit waste where they should not. We also get sewer line blockages such as cows and dead dogs.

There has been an increase in water demand, which is a challenge: we need to harvest and to conserve. Water demand is higher than what it should be.

Finance covers the revenue part. There are issues regarding metering: there are unmetered areas, and metered areas, but meters are dysfunctional or are not read. Finance is responsible for reading meters.

Danie van der Merwe

Context

Danie Van der Merwe heads the hydraulic modelling in strategic functional planning in a corporate office, dealing with master planning and the upgrading of the asset register.

Focus is different to what the other municipalities have in terms of having differing levels. We try and maintain a high-level waterborne sanitation. Capacity is not always there, looking at certain criteria and looking at in some cases having septic tanks. It depends on certain criteria.

In informal settlements, we are renting chemical toilets and have a few VIP latrines, but very few. We also have an initiative in informal settlements where you can have waterborne, where we put down containers.

Institutional

In planning for sanitation, the lack of skilled practitioners is a problem. Water wise, we are opting to have pressure towers instead of booster pumps, because of the skills requirements. Working with sewer

pumps is fine. Institutional wise the skills are plumbers who execute the work and do maintenance. We also do not have enough staff. When the ratio of a metro of their size in term of infrastructure is compared, our ratio is very low. Others have around 5000 staff we have 1000.

Training and in-house training is done to get lower levels qualified. But, when people are qualified, they leave the institution. There is an institutional issue as well, people are not enjoying the environment. There is a lot of job hopping: within, and to the private sector and Rand Water. We need to retain staff for institutional knowledge. Might need to sign commitments along with training. We need succession planning.

Finance

In terms of procurement, by way of example, we said that an estimated cost for feasibility is R2.5 million. But, we have realised this is far too little, but have been capped, so cannot go beyond that.

In terms of physical funding for planning, it is not a problem, but for construction there is a shortage of funding and we cannot really reduce our backlogs. Finance determines how much of the cake we get. But if we get R800 million today, can we spend it? There are no project managers, and we need contract administrators.

Technology

For treatments, we have a municipal entity, namely, the East Rand Water Care Company (ERWAT). They were originally section 21 but have changed so that they can get MIG funding, grant funding and so on.

We have a contractor that deals with chemical toilets, which is an immediate solution. The contractor cleans, operates and maintain the toilets at a cost of about R100 million. Sometimes there are toilets that are damaged and burnt, but this is often a social issue and not a technical issue.

Conservancy tanks (earlier) the municipality does not provide septic. Problem with conservancy tanks, we tell the guy he needs to sort out emptying of tank on a regular basis. Environment, and where they are going to dump? We ask them to apply and specify a site, but we cannot enforce. So, we can get peaks and floods in the system.

Rather opt for a closed sewerage system due to the dolomitic conditions. Where townships have been established on dolomitic areas, we sometimes get sinkholes, which can damage the infrastructure. This also affects where they lay ablution blocks. Hence, we tried dry sanitation, around 2007, but only introduced about 2000 of those. There is an educational problem. People did not know how to use it, did not know what to do with the waste, and it was possibly politicised. So, we continued with long drops instead.

Because of capacity issues that we have at the treatment plant, people want to put in package plants, one or two are currently installed. But, we need an institution to operate and maintain that, that need to be qualified. The concern is if something goes wrong, we do not have jurisdiction over those, but we get directives from DWS.

Land

Land is not an issue for sewerage as all treatment is done on ERWAT property. We want to build a 2000 MW plant at Rietvlei Dam. The guy they are dealing with is a bit of a problem, as he wants to develop. But others are fine.

In terms of informal settlements, when we put down chemical toilets, density means we cannot even get in with a bakkie. Need to get ward councillor to get the community to make space.

Weekly meeting with human settlements, have a migration plan, certain settlements can be upgraded in situ. Not a land issue for sewer though.

We have a hydraulic master plan, which informs the links etc.

4. City of Johannesburg

Nomvula Mofokeng

Nomvula is deputy director for water services regulation and policy development at the CoJ.

Institutional

The CoJ is the WSA and has appointed Johannesburg Water as the WSP. Johannesburg Water is 100% owned by CoJ. As the WSA, its mandate is an oversight and regulatory role over Johannesburg Water. This entails monitoring Johannesburg Water through its business plan and balance scorecard against the set norms and standards in the Water Services Act using key performance areas extracted from the National Water Services Regulation Strategy as well through the service delivery agreement and service level agreement between the CoJ and Johannesburg Water.

Johannesburg Water has a board who provides oversight to the organisation, but who also reports to the CoJ. Johannesburg Water's performance is reviewed quarterly by the CoJ through quarterly reports submitted by Johannesburg Water. As assessment report is done by the CoJ based on Johannesburg Water's quarterly report, and verification of site visits to projects undertaken by the CoJ. Meetings between Johannesburg Water and the CoJ are held as and when the need arises. The CoJ is responsible for the development of by-laws and policy while Johannesburg Water is the implementing agent.

This arrangement between CoJ and Johannesburg Water does work, but there are occasions where there is not full disclosure from the WSP. There is also limited recourse and consequences should Johannesburg Water does not perform or meet key performance indicators.

Finance

CoJ transfers a portion of Equitable Share and capital grants received to Johannesburg Water. This is usually based on applications from Johannesburg on the quantum of funding required and the associated need.

Technology

Waterborne sanitation is provided in formal urban areas. VIP latrines, chemical toilets, and CABs are provided in informal settlements. The city is also currently piloting new technologies. This includes a flush toilet that uses recycled grey water for CABs.

Congestion in informal settlements often limits the technology options that can be implemented. This needs to be communicated to residents as questions are asked as to why different settlements have different sanitation solutions being implemented. Relocating households from informal settlements to reduce congestion is not easy as people have jobs and family responsibilities to attend to.

Land

Providing services on privately owned land is a challenge for the CoJ. There is a national policy on this subject. Johannesburg Water will have further details.

Community

A further challenge is the resistance received from communities living in informal settlements when providing sanitation solutions. Communities often want a formal housing structure and providing temporary services suggests that they will never be provided with a formal structure. Some residents living in informal settlements are not South African citizens and thus will not qualify for formal housing provided by the state.

Other

The CoJ is rolling out prepaid water meters to reduce water demand and improve water management. It is important that this is paired with a strong public participation process in which the community can be engaged. User education and awareness is crucial to the success of the project.

The CoJ is in the process of developing a standard for backyard dwellers.

Political interference is a further challenge on the ground during the implementation of projects.

Enoc Mudau

Enoc is the Senior Manager: New Services Development Division. Part of his responsibilities includes oversight of the implementation of sanitation projects in informal settlements.

Enoc has a team of 30 people, of which nine are directly involved in the delivery of sanitation in informal settlements. The total operational budget for the year is approximately R39 million with R35 million being used to provide basic sanitation to informal settlements.

Institutional

The CoJ has a housing department that is responsible for providing formal houses. Johannesburg Water is responsible for providing basic services in informal settlements. There is some engagement between Johannesburg Water and housing regional offices to determine the need for providing services, but generally Johannesburg Water is aware of the challenges and the settlements in which interventions are required.

The DHS checks with Johannesburg Water's development control department prior to any housing development being approved. Development can only begin once Johannesburg Water has confirmed that there is sufficient network capacity available.

Politically, the DHS is under pressure to deliver houses and this can cause challenges in which developments proceed without Johannesburg Water giving the final approval. However, there is good communication between Johannesburg Water and DHS.

Johannesburg Water is required to provide temporary services to informal settlements. However, permanent solutions are often provided during the formal housing process. Thus, an improvement in the coordination of the housing programme could lead to decrease in the installation of temporary solutions and an increase in permanent solutions.

For example, DHS could provide a township structure on available land, then line departments can provide permanent services while residents can install their own top structures on the serviced plots. This may be a more efficient way of handling the situation as currently people are moving between informal settlements, which requires a constant need for temporary services.

Finance

The installation of VIP latrines in informal settlements are considered to be an operational cost because the services are provided to each household and thus cannot be capitalised. It is thus considered to be an operational expenditure.

Technology

The CoJ effectively provides three different levels of service. These are:

- Nominal – Chemical toilets and water tankers.
- Level 1 – Basic level of service (VIP latrines and CABs) in informal settlements.
- Level 3 – Reticulated metered yard connections for water and sanitation.

The nominal service is considered to be below a basic level of service (Level 1). Chemical toilets are usually shared and not provided for each individual household.

Johannesburg Water is currently testing a product called Bio-Mite, which uses recycled water for flushing. This could be used in areas that do not have water connections if testing proves to be successful.

Resistance to technologies

Typically, people are not resistant to any form of sanitation that the municipality is providing as it is usually an improvement on their current situation. For example, the decision to install VIP latrines is not met with resistance as this is seen as an improvement from sharing chemical toilets. However, the resistance arises if residents are disappointed over the protocol that has been employed.

For example, housing is usually the priority for people living in informal settlements. Residents sometimes feel that providing VIP latrines after they have occupied that piece of land for 20 years is a delay tactic being employed by the municipality. This often precedes the resistance from communities.

Land

The main issue around land is if the land is owned by a party other than the municipality. Some owners require the municipality to obtain permission to occupy while others simply refuse to engage with the municipality. Johannesburg Water does not install services on privately owned land.

Community

Johannesburg Water has a team for social interventions that is situated within the New Services Development Division. There are seven people in this department, which include six community development officers and a manager. Their role is to engage communities to obtain buy-in and raise awareness. The community development officers contact councillors and hold community meetings.

Other

Political cycles and five-year contracts also have an impact on the sanitation business. Firstly, newly appointed officials need to understand the nature of the challenges that the business faces. Further to this, some officials may wish to change the plans that are currently in place for political reasons.

The three main urban sanitation challenges that Johannesburg Water faces are:

- Congestion within informal settlements as this prevents the installation of infrastructure.
- Insufficient land to allocate for formal services to be provided in a structured manner.
- Geotechnical conditions due to informal settlements being unplanned. There underlying conditions could also make it difficult to implement sanitation solutions. For example, high water tables mean that you cannot install VIP latrines.

Johan Koekemoer

Johan is the General Manager of Finance at Johannesburg Water. Johan's team includes finance and metering staff at the entity.

Institutional

The CoJ is the WSA and has appointed Johannesburg Water as the WSP. Johannesburg Water is 100% owned by CoJ. The result of this arrangement is that the CoJ will determine profit margins on operations and funding for capital expenditure. The final operating and capital budgets are approved by the city.

Finance

The current institutional and finance arrangements between the city and Johannesburg Water do work well although there are limitations at times. These limitations are detailed below.

Operational expenditure

On the operational side, Equitable Share funding is transferred to the CoJ from National Treasury. However, Johannesburg Water does not receive any Equitable Share funding from the city. Johannesburg Water generates all revenue from tariff income. The cost of providing the service to low-income households are subsidised by higher income households and other non-residential consumers.

The water side of the business is currently generating a loss, which is covered by a surplus that is made on the sanitation side of the business.

Capital expenditure

The CoJ receives USDG funding from National Treasury. Johannesburg Water then applies to the CoJ for grant funding for the capital programme. The current annual capital expenditure programme is approximately R790 million. However, this is decreasing in real terms. The result of this is that Johannesburg Water is replacing less than 1% of their assets annually. This will create a backlog of renewal that will have to be undertaken by future generations.

Funding for the capital expenditure programme is determined by the city. USDG is allocated to Johannesburg Water on an allocation basis while the CoJ uses the balance sheet of Johannesburg Water and the other entities in order to raise debt finance. This is allocated based on the discretion of the CoJ.

Capital expenditure has to be undertaken in a consistent manner to prevent a backlog in renewal occurring. This could pose a significant threat to the sustainability of the business in future. The result of decreasing renewal on existing infrastructure now, can also result in significantly higher expenditure in future.

Technology

Johannesburg Water provides a Level 3 service (full water and sewer connection) to most households within the municipal boundary. Level 1 service is provided to some households.

Chemical toilets are not the preferred level of service but are provided to residents in areas in which VIP latrines cannot be installed. Geotechnical conditions are the main reason for not installing VIP latrines. CABs are also provided in certain areas, usually where there are hostels. The hygiene in these areas are usually very poor and the result is a reduced service to residents.

Providing waterborne sanitation to all households would possibly be the best solution for Johannesburg Water and residents. This is because chemical toilets and VIP latrines are sometimes more challenging to operate and maintain than waterborne sanitation. However, formalising informal settlements is a challenge and the planning associated with this has to be improved

Land

Privately owned land is a challenge for Johannesburg Water, which is outside their control as this is the responsibility of the housing department. No infrastructure can be provided on privately owned land.

Community

Residents refer to chemical toilets as buckets as highlighted during Census 2011. Residents sometimes feel that VIP latrines and chemical toilets are a substandard level of service. Waterborne sanitation is what most people want but most people probably cannot afford it. The high costs are due to space requirements, water use and water losses.

Other

User education and community engagement can also be improved. Residents sometimes discard foreign objects in the sewer network, which results in blockages and spillages. Improving user education and community engagement has financial implications.

5. Key of Hope

Key of Hope is dedicated to providing long-term mentoring relationship with children who have been orphaned by, or otherwise affected by HIV and AIDS. The organisation was started in 2008 to work with orphans and HIV/AIDS affected children. Key of Hope currently works with approximately 2000 children in informal settlements and has a total staff complement of 16.

The organisation has witnessed the various shortcomings of sanitation solutions in informal settlements during weekly visits to the children that the organisation has identified. Key of Hope worked together with EWS on a community garden in 2009, and they have worked together regularly since.

Access

One of the main challenges is access to sanitation. Many of the homes in informal settlements do not have access to water or toilets. A child who the organisation has worked with has had to walk more than one kilometre away to use a toilet at a garage.

Maintenance of existing infrastructure

A further problem is the state of disrepair of existing infrastructure. There have been instances in which failing infrastructure has been reported to the municipality but has not been repaired for years. In some cases, even temporary facilities are in such a state of disrepair that residents cannot use them.

The topography of the land in Durban is such that a broken sewer can lead to waste water being discharged down the hill and affecting several households and children. The topography and density of informal settlements may also make it difficult for technicians to repair failing infrastructure.

Technology

Residents would probably be willing to accept a VIP latrine if it was provided with a formal housing structure. Pit toilets in a rural setting may be adequate but not in an urban informal settlement due to the high-density and proximity to the homes of the users. This causes health and hygiene issues. In general, residents seem willing to accept CABs as an adequate temporary level of service.

CABs generally work quite well but the key element is engaging the community and appointing a janitor. The right people in terms of support and care about the facility contribute to making the use of the facility successful. The context varies widely from community to community and Key of Hope has seen CABs working well to being unusable and closed within a year. In general, residents are willing to accept CABs as an adequate level of service.

6. Africa Ahead

Africa Ahead is a small NGO active since 1995 that has developed and implemented the Community Health Club Model to scale up community participation in sanitation and other issues. It was founded in Zimbabwe ad currently works primarily in the Democratic Republic of the Congo, Rwanda and Uganda in rural settings, but has previously applied its methodology in urban settings in the City of Cape Town, from 2005 to 2007, and eThekwini in 2009.

The Community Health Club Model was developed in response to contemporary community health challenges and approaches to address them. It was identified that the methodologies, such as the social marketing approach, in use at the time were not galvanising sustained change in the communities where they were applied. The methodology involved creating small clubs, which were localised around an individual piece of infrastructure, such as an ablution block, and discussing health issues and solutions to these. These start out but doing hygiene troubleshooting and then go on to deal with deeper issues, resulting in the community taking responsibility for ensuring that there are solutions to their sanitation issues.

In eThekwini, Africa Ahead ran a small project to improve the living standards of the residents of the Joanna Road informal settlement. The informal settlement was relatively well serviced by the municipality with ablution blocks, standpipes and solid waste removal, but the area was very problematic in terms of health and hygiene. The project focused on cleaning up the informal settlement and getting residents to use the ablution blocks better. The project was however too small to be cost-effective and needs to be scaled up to be sustainable.

The Cape Town project Africa Ahead trained the University of Western Cape's Community health workers. A manual and training materials were prepared for the City of Cape Town. It was estimated that as many as 400 community health clubs were formed in Cape Town informal settlements.

Technology

From the perspective of Africa Ahead, there are limitations to the possibilities for technical solutions to sanitation issues. While the organisation recognised the problem of a lack of infrastructure and, in particular problems with the bucket system and chemical toilets, providing sanitation infrastructure such as ablution blocks was not seen as full solution. The key to resolving sanitation issues in this instance, is mobilising the community before the infrastructure is delivered to develop ownership of the infrastructure, and improve the likelihood that the community will use and maintain the infrastructure properly. While this is a more time-intensive approach, it is regarded as likely to produce better outcomes.

Community

Africa Ahead's perspective on engaging communities was to ensure that health clubs should be grouped around facilities. When clusters are formed around an electricity pole for instance, you can get about a hundred households in a club and select a working committee on each issue affecting the community, with a representative to deal with each and interface with a municipal official. This gives the community a point of communication. In informal areas, nobody wants to clean up some else's waste and you need to create a system to arrange this. The key to doing this successfully is to focus on positive issues, such as improving health, rather than a direct problem-solving approach.

A municipal perspective

Africa Ahead's experience of engaging with municipalities has been largely positive though the dependence on champions for the projects such as the late Dr Ivan Toms. Long-term buy-in was identified as a threat to the sustainability of the Community Health Club approach in eThekwini, and politicisation of health clubs in Cape Town has constrained some.

7. SJC

The Social Justice Coalition (SJC) is a community organisation founded in 2008 that works to advance the constitutional rights to life, dignity, equality freedom and safety in South Africa, and particularly for residents of informal settlements. It has 13 branches, primarily located across Khayelitsha in Cape Town. It runs local government programme campaigns on sanitation, budgets and urban land.

The organisation's sanitation campaign was borne out of anger in communities around the safety of accessing sanitation service in Khayelitsha. These concerns centred on distance to facilities, the need to cross roads to access them, and the vulnerability of people accessing them of being robbed and assaulted, particularly at night. The sanitation part of the local government programme looks at municipal budget allocation to sanitation, social audits and monitoring service delivery.

The SJC engages primarily with officials and politicians from the City of Cape Town, and to a lesser degree with officials from the Western Cape Provincial Government and the national government.

Finance

The SJC started working with the International Budget Partnership in 2014, looking into budget transparency. They have reviewed Cape Town's budget from 2007 to 2014/15. They argue that the city

has produced an unfair budget that does not distribute resources equitably. The city has allocated only R22 million from the capital budget to provide flush toilets in informal settlements in 2015 in comparison to R106 million for a parking garage for the city's finance directorate. Under the budget framework, only the installation of flush toilets comes under the capital allocation. The provision of other services, like chemical toilets and portable toilets, is an operating expense. The SJC also argue that the direct capital allocation informal settlements received has remained the same since 2007, while capital allocation to waste and sanitation has grown significantly. The SJC encourages the community to participate in their budget transparency processes and the city's budget process.

Technology

In the SJC's understanding, 73% of the toilets provided to informal settlement are temporary toilets, but they argue that informal settlements are demonstrably not temporary, with 80% lasting over 10 years. The temporary toilets provided are primarily porta potties, container toilets and chemical toilets. Only 27% of toilets are flush toilets. It is argued that temporary solutions are expensive and of inferior quality. They are reliant on private service providers for servicing and communities struggle to monitor these service providers and hold them to account.

Flush toilets are preferred by communities, but these are communal and used by many people. They are also prone to blockages, and sometimes sewage overflows leading to health issues. There is a need for sanitary bins, and in the cases of pour-flush toilets, taps are sometimes not nearby. Then there are also safety questions around getting to communal toilets at night.

Community engagement

The SJC is membership based, and they currently have branches in 13 informal settlements, with potentially two more coming online. They have weekly branch meetings where members engage around issues. Each branch runs events, clean-ups in and around these areas. They include a street committee member on the branch staff.

One of the problems that the SJC identifies with the city is that the spaces that exist for public participation are not functional and are not working to effect what they were created for. The municipality still want people to engage in the formal invited spaces such as the IDP meetings, rather than to engage the communities. But communities do not feel comfortable engaging in these. The SJC argues that public participation would achieve far better outcomes using invented spaces created by the community where community members feel more comfortable raising their issues, but official are reluctant to attend these engagements.

Furthermore, the SJC argues that the city does not properly conduct engagement, that citizens are not given the proper space to provide input to the budget and plans, or when there is protest, there is not a space to engage, just a memorandum handed over. There is no space for communities to continually engage with city officials, only with politicians, while the communities would prefer to engage with officials or the service providers themselves in the case of outsourced services.

Institutional

The SJC identifies poor coordination within the city as a significant problem. This is particularly the case with the human settlements department and the city health department.

Maintenance and monitoring

The SJC engaged the city about starting a janitorial service, which was started in 2012 after a long but useful process. The janitorial service employs local people to look after the maintenance and cleaning

of communal ablution facilities. The SJC monitors this service, asking the janitors about the equipment that they were provided with, particularly for health and safety and the training that they received (training that was supposed to include some plumbing skills). They also asked the residents about the cleanliness and functionality of the facilities. The safety equipment was found to be inadequate and the skill training less than what was promised. As a result, residents said only the outside of the facilities were adequately maintained but not the inside. The SJC raised this with the city and eventually had to go public. There has subsequently been some improvement.

A municipal perspective

The municipality faces the systemic problem of post-apartheid South Africa with a large portion living in poverty and being unable or unwilling to pay for services. The government has the obligation to provide services to poor households; however, the current economic climate makes it difficult for the government to raise revenue via taxes. This results in the funding available to municipalities being inadequate to provide free services to residents and sustainably operate their business.

8. SDI Alliance/CORC

The South African Branch of the SDI Alliance has four primary partners. They are the Federation of Urban and Rural Poor (FEDUP), The Informal Settlement Network (ISN), the CORC and the uTshani Fund. It aims to pioneer people-centred development initiatives by the poor, and thus involves itself in initiatives like the Peoples Housing Process and informal settlement upgrading.

CORC is an NGO that supports the social and technical process of FEDUP and ISN and assists them to develop strategies for inclusive cities by facilitating engagements with formal actors like municipalities and the state. It supports the development of savings, data collection, learning exchanges, community-led projects preparation and implementation.

Institutional

CORC has a partnership with the City of Cape Town, helping them look at the agenda of upgrading informal settlements and water and sanitation issues. These include establishing where in a settlement the city should install toilets, through engagement with both the city's engineers and communities. They assist communities in planning space to allow the city to provide the infrastructure services, in processes such as the reblocking of settlements.

CORC identifies the traditional way of doing things in municipalities as the biggest institutional barriers they face, and professionals within the institution being unwilling to sign-off on innovative ways of doing things, such as reblocking the informal settlements.

Another institutional challenge the municipality faces is finding service providers who are prepared to work with communities in the way communities want to work. Communities want to focus on developing small clusters at a time, with widespread engagement. Contractors, however, do not find this as profitable as building on a larger scale. This complicates the procurement and finance processes on the municipalities side.

Technology

CORC's experience is that communities want water and flush sanitation technologies. The challenge with this however is constrained water supply and the ability to bring infrastructure for flush toilets into informal settlements.

However, CORC has had some success in introducing new technologies to communities, for example Enviro Loos. They identify the need to deal with the mind shift that is required in communities to accept a new technology. They have a process for creating this shift. Firstly, a new technology should closely resemble a flush toilet and its benefits. Secondly, the community should be exposed to the technology. CORC has done this by taking members of households in their communities to see the technologies being practically used successfully, and compare different options. They can then talk to the rest of the household about the advantages and disadvantages of the new technologies. Thirdly, the community needs to be involved in the design of the application of the technology in their area, so that they are designing their own solutions. Allowance needs to be made in upgrading for the time to allow communities to engage and devise their own solutions.

Land

Land is understood to be a challenging issue, but the organisation sees land as an issue that political and administrative will have to face. This manifest is two ways: firstly, is that provision of housing infrastructure primarily happens on municipal land, which is not necessarily optimal land for the communities that is developed to serve. The second is that is the need to upgrade informal settlements is created because there is an unwillingness to provide worthwhile land to informal settlements residents.

Community

ISN is made up of communities' leaders, and they use their own personal networks to engage communities. ISN then works as a single aligned voice for informal settlement dwellers. They try to engage with other community leaders and community structures to ask how the communities are engaging with the municipality. ISN tries to assist communities in building the information that they need. For the technical aspects of this information they bring in the CORC's expertise, this is particularly for CORC to assist around planning and enumeration activities. It is about building the community itself to get to a point where it works together to get the information.

The main barrier to engaging communities is trust. There is a risk for the organisation to look like it is making promises to the community. But this can be overcome by building partnerships around who the organisation is engaging with.

ANNEXURE B: REVIEW OF URBAN SANITATION IN THE WESTERN CAPE – PHASE 2 BRIEFING DOCUMENT

Review of urban sanitation in the Western Cape

Report to the

WATER RESEARCH COMMISSION and WESTERN CAPE GOVERNMENT: DEPARTMENT OF HUMAN SETTLEMENTS

by

Rajiv Paladh, Nick Graham and Meagan Jooste

PDG

March 2016

1 INTRODUCTION

1.1 Purpose of the study

Since 2000, the national government has embarked on a series of initiatives to reform water supply and sanitation policies. These reforms were aligned with decentralisation which devolved the responsibility for the provision of sanitation to local government. However, despite the progress made by local government, there are still over 3.3 million households (1 in every 5 households) in South Africa that experience sub-standard sanitation services (StatsSA, 2016).

2 CONTEXT

What is the scale of the sanitation challenge?

In the Western Cape, the sanitation challenge in informal settlements is large and growing. The table below shows the latest dwelling counts per municipality, as well as the number of serviced toilets and the additional number of units that would be required for a servicing ratio of 1 toilet per household (1:1).

Table 29: Informal settlement dwelling count and sanitation status

Municipality	Dwelling count 2015	Number of toilets	Unserved dwellings at 1:1
City of Cape Town Metropolitan Municipality	146 626	21 114	125 512
Beaufort West Local Municipality	41	4	37
Bergrivier Local Municipality	94	2	92
Bitou Local Municipality	1 920	116	1 804
Breede Valley Local Municipality	9 175	556	8 619
Cape Agulhas Local Municipality	790	68	722
Cederberg Local Municipality	2 643	557	2 086
Drakenstein Local Municipality	3 491	823	2 668
George Local Municipality	2 865	766	2 099
Hessequa Local Municipality	555	9	546
Kannaland Local Municipality	193	3	190
Knysna Local Municipality	4 953	742	4 211
Langeberg Local Municipality	1 200	57	1 143
Matzikama Local Municipality	389	10	379
Mossel Bay Local Municipality	1 721	289	1 432
Oudtshoorn Local Municipality	1 625	222	1 403

Overstrand Local Municipality	3 485	234	3 251
Prince Albert Local Municipality	-	-	-
Saldanha Bay Local Municipality	4 250	1473	2 777
Stellenbosch Local Municipality	8251	626	7625
Swartland Local Municipality	880	327	553
Swellendam Local Municipality	480	23	457
Theewaterskloof Local Municipality	4 562	450	4 112
Witzenberg Local Municipality	2 077	146	1 931
Total	**202 266**	**28 617**	**173 649**

Source: Own analysis based on Western Cape Informal Settlements Database 2014 and City of Cape Town Informal Settlements Database 2014

The concept of a 'backlog' differs depending on the service standard, i.e. if the standard is one toilet per household (1:1) or one toilet per five households (1:5). The figure below illustrates how the 'backlog' will increase over time given population increases, under the current rate of housing delivery (business as usual scenario), for each of the two service standards.

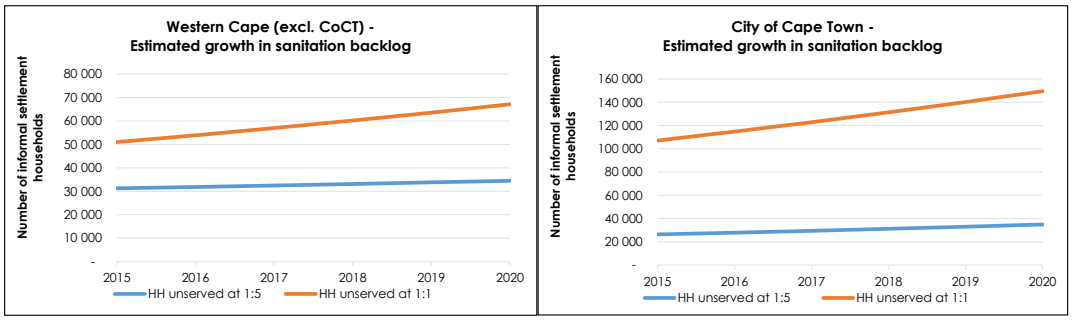

Figure 19: Estimated growth in sanitation backlog – Western Cape (excluding the City of Cape Town) (left) and City of Cape Town (right)

3 OPTIONS ANALYSIS

The options analysis undertaken in Phase 1 investigated at a high level the intervention required to achieve a 1:1 target (providing each household with a toilet, by 2020) versus the business as usual scenario[15]. The number of additional units that would need to be provided escalates rapidly, to a peak of almost 60 000 additional units in 2020. (Figure 20).

15 Derived from baseline information made available to the project team on the housing pipeline projects as well as forecasted capital and operating expenditures

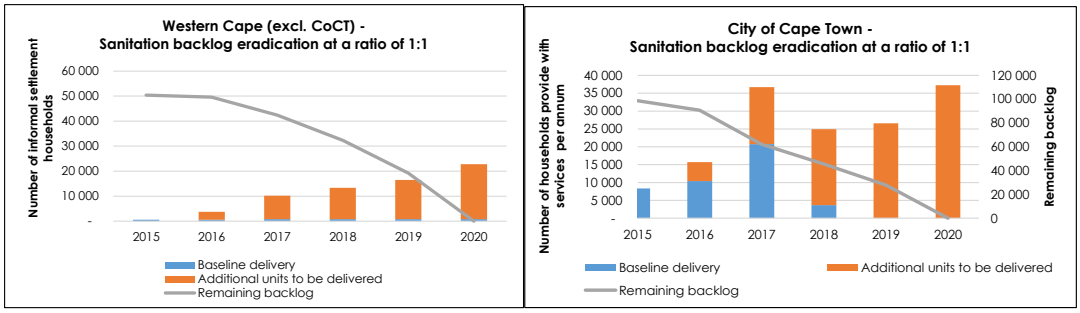

Figure 20: Eradication of the sanitation backlog at a ratio of 1:1 – Western Cape municipalities (excluding the City of Cape Town) (left) and City of Cape Town (right)

The NUSP categorises settlements into four categories depending on whether they can be upgraded in-situ, can receive temporary services, or need to be relocated. To estimate the high-level cost of the intervention, these categories were extrapolated to all municipalities in the Western Cape and certain sanitation technology solutions were assumed for each category (see Annexure 1).

The analysis in Phase 1 prepared as an 'order of magnitude' cost estimate of providing 1:1 sanitation in the province by 2020 (assuming this is possible) in order to assess the sufficiency of the funding. The results of the cost estimate from Phase 1 are shown below:

Table 30: Summary of high level cost implications of 1:1 servicing

	Total capital cost of infrastructure (R million)	Additional Operating cost in 2020 (R million pa)	Increase in capital budget required by 2020*	Increase in sanitation capital budget by 2020*	Increase in operating budget by 2020*	Increase in sanitation operating budget by 2020*
Cape Town	728	690	4%	41%	2%	42%
LMs	507	28	9%	48%	3%	3%
Combined	1 235	719	5%	44%	2%	29%

*as a percentage of 2015/16 budget

4 SYNDICATED ANALYSIS REVIEW

4.1 Land, finance and institutions

4.1.1 Land

How many settlements have which category of land constraint?

The NUSP rapid appraisal methodology provides a first assessment of the hard constraints faced by settlements. The rapid appraisal being undertaken by the Province will expand this classification to more municipalities and provide a better picture of exactly which constraints occur where. However, the severity of constraints will vary considerably and more context-specific issues that need to be dealt with on a case by case basis to determine which sanitation technology is possible and appropriate. It is notable that the extrapolation of existing data reveals that only an estimated 24% of households live in settlements that need to be relocated (Category C). This means that the remaining 76% of households (Categories A, B1 and B2) will need to be provided with some sort of service in their current location and thus the sanitation solution needs to accommodate the existing constraints.

What are the implications of the hard constraints around land?

The above statistic indicates that informal settlements are here to stay and tenure security and land ownership should be a priority to provide the required platform from which service provision can be expanded in a sustainable way. Thus the issue of providing services on privately owned land requires urgent further investigation and discussion with National Treasury to clarify how the relevant provisions of the MFMA and GRAP can be accommodated in this instance. The Health Act appears to provide adequate authority for municipalities to provide sanitation services on private land, but greater use can also be made of expropriation to create the required servitudes or to transfer the land to the municipality.

How are the possible options impacted upon by settlement density and what are the options for overcoming each of these?

While calculations have been undertaken using density thresholds, these cannot be looked at in isolation as there are numerous other factors that determine whether a settlement can be provided with a particular technology or level of service. On-site options for individual household servicing are generally not viable at high densities (>50 du/ha). In the City of Cape Town the average settlement pocket density is 166 du/ha and only 60 settlement pockets have a density less than 50 du/ha. In non-metro municipalities, the weighted average density is 110 du/ha with 128 settlement pockets (out of 437) having densities less than 50 du/ha. Thus in most cases some form of off-site waterborne conveyance is required. Density also means that it may be difficult to provide conventional waterborne sanitation as there is not space for the trenching required for sewers. In this case a communal block may be viable, or a number of alternative waterborne options such as simplified sewerage[16] or utility walls[17] could be feasible. However, re-blocking is a useful first step that provides multiple other advantages in addition to making the provision of services easier. In settlements that are going to be upgraded permanently (and even those that are not) re-blocking would probably be advisable to improve settlement efficiency.

4.1.2 Finance

How much funding is required?

Changing the sanitation game in the Western Cape will require significant resources, both financial and human. In order to achieve a target of 1:1 servicing (if this were technically possible), it is estimated that R1.24 billion *additional* funding would be required for infrastructure. However, this excludes the pre-implementation costs, which could amount to a minimum of R50 million, and additional staffing costs at municipalities and the Province. The constraint on pre-implementation is likely to be human capacity, as these costs imply a participatory planning process in all 481 settlements in the next 5 years.

The roll out of 1:1 servicing would require a 44% real increase in municipal sanitation capital budgets by 2020 and a 42% real increase in sanitation operating budget in the City of Cape Town between 2015 and 2020. If the current institutional arrangement is preserved, the increase in operating costs for municipalities is significant and will be many times higher than the capital investment required. Surprisingly, providing a higher level of service is cheaper than costly on site systems such as chemical toilets. But the unit cost saving needs to be seen in relation to the large increase in total costs of providing sanitation based on the increase in the number of households served.

16 A system of small diameter sewers laid at shallower gradients and using simpler manholes than conventional sewerage.

17 Walls built through settlements that contain water, sewerage and electrical connections, against which dwellings can be built.

If there is a maximum density above which waterborne sanitation to each household is not feasible, then in order to achieve 1:1 servicing, households will have to be relocated to greenfield sites, which may have to be purchased and would need to be provided with a range of services, not only sanitation. Using a theoretical maximum density threshold of 110 du/ha (which happens to be the current weighted average density of informal settlements outside of Cape Town), the rate of delivery of greenfield housing opportunities would need to double in relation to existing plans. If only A-grade services are provided to these additional greenfield sites, an additional R443 million per annum would be required from the housing subsidy. This excludes any top up on land cost above the R6 000 per site[18] allowed for in the subsidy, as well as the increase in human resource capacity that would be required in Province and the municipalities. This is an unlikely scenario and therefore points to the need to find a solution that provides for more in situ servicing at higher densities. Alternatively the servicing ratio could be increased to reduce relocation.

What government funding sources are available to finance the provision of sustainable sanitation in informal settlements, what is the quantum of this funding and how can this be accessed?

It is estimated that only R486 million[19] of capital grant funding is available for sanitation in the Western Cape, made up from the USDG (57%), the MIG (27%) and the HSDG (16%). These are currently the only relevant government grants.

Operating cost estimates for the various sanitation technologies show that the indicative equitable share allocation for sanitation is only sufficient to cover the operating costs of waterborne systems and the cost difference for on-site systems would be borne by municipalities.

What funding is currently spent on sanitation in informal settlements?

In the next three years it is estimated that the Provincial DHS will spend approximately R1.1 billion in capital on the sanitation portion of housing programmes (formal and informal) up to 2018 using the HSDG, or an average of R367 million per annum. Municipalities in the Western Cape have budgeted approximately R994 million on sanitation infrastructure (formal and informal) in 2015/16, and 2.5 times this amount in operating expenditure. The proportion of these budgets spent on informal settlements is not known, but is expected to be only a fraction of this.

How much of the available funding has been committed to other projects and how feasible would it be to direct this to the sanitation game changer?

Funding that has been committed to other capital projects in the Medium Term Expenditure Framework would be difficult to direct to other projects after capital budgets have been approved. Capital projects are drawn from the IDP and are approved through the capital budget annually by the council. In addition, certain grant funding is specific-purpose and conditional and therefore may not be transferred for another purpose. Any shifting of budgets towards sanitation is likely to only happen in 2018/19 and 2019/20. There is, however potential to shift the allocation of the HSDG to prioritise sanitation if the Housing Code were amended and national DHS agreed to this.

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18 This cost is likely to be the highest in Cape Town, where it was reported that this is double the cost in other municipalities.

19 Calculated from the Division of Revenue allocation of grants to the Western Cape and City of Cape Town, and apportioned to sanitation using historical spending patterns and the housing subsidy quantum allocation for sewerage.

What are the blockages in the provision of funding, and what is required to overcome these?

The state-centred funding option would be to increase grant allocations to municipalities while at the same time relaxing the conditions to allow funding to be diverted towards sanitation. This increase should be aligned with an increase in the sanitation outcome targets for a programme level funding instrument (not unlike the USDG) and will create a more flexible project level instrument. It is unlikely that any new grants are likely to be created for sanitation, given that USDG funds have already been ring-fenced and a bucket eradication grant is coming to an end. The only government funding option appears to be a shift in the prioritisation of the existing grants towards sanitation, which will be gradual, if anything.

What are the potential non-government funding models and what is required to unlock this?

The informal settlement context in South Africa indicates potential for interlinking savings, microfinance, household contributions and donor funding. Urban service microfinance instruments can be employed to leverage communal savings. Furthermore such settlements which display these levels of commitment and demand are likely strong candidates for skills training programmes provided by NGOs and commonly funded by donors. In many international cases such systems are the sole model for basic sanitation services and if scaled up could potentially have a large impact on sanitation service provision in the Western Cape. However the primary challenge to this will be addressing the market conditions required, particularly the distortive disincentives of tenure vulnerability and service level provided with free housing. These disincentives may make South Africa less attractive to donors than other developing countries.

An innovative approach that is being advocated by CORC is the idea of a 'City Fund' which is jointly contributed to by government, the private sector, donors and communities and managed as a Public Private Partnership. Government funding for sanitation could be used to leverage donor and private sector funding in this way. There may even be advantages to pooling municipal funds to overcome the 'lumpiness' of project timing and investments. The legal and practical implications of such a pooled fund would need to be investigated further. SALGA has undertaken research in this regard, albeit in relation to an infrastructure rehabilitation fund, and this research could be drawn upon to build a business case for such a fund.

What are examples of best practice in financing and procurement?

There are numerous international examples of alternative funding mechanisms for informal settlement sanitation using mixtures of donor funding, savings clubs and microfinance. Household contribution is a common success factor from case studies of international best practice. The importance of co-funding in a participatory approach is that it encourages ownership of the facilities by residents, but also prevents the state from monopolising control over decision-making. Community control over at least part of the sanitation budget needs to be explored. In the South African context community-based funding has been used successfully, but never at scale or with major state involvement. The impediments to this approach include the requirement for significant effort in organisation and support, the lack of tenure security reducing household investment, and the disincentive to fund interim or alternative services due to the expectation of a formal house through the national housing programme.

What is the cost of non-technical components (e.g. employing intermediaries, community facilitation, enumeration, surveys, capacity building, knowledge sharing, etc.)?

The costs of pre-implementation facilitation and planning will vary from settlement to settlement depending on a range of factors. However, rough estimates gained from the Project Preparation Trust

and CORC range from R80-R216/hh, excluding municipal and intermediary staffing costs[20]. If one multiplies these costs by the current number of dwellings (ignoring settlement growth), a rough calculation of the cost of pre-implementation participatory planning (excluding human resources) is between R20 million and R55 million. This is likely to be a low estimate due to the complexity of running processes in multiple settlements and the inevitability of the processes taking longer in some settlements.

What are the potential funding sources and models for these components and how can these funding options be accessed?

Currently, the UISP funding framework in the Housing Code allows for 3% of the subsidy amount to be spent on project preparation and social facilitation (DoHS, 2009). The social facilitation portion of the indirect cost included in the HSDG subsidy is R316.41 per household for all services. Interestingly, this is higher than the benchmarks provided above, but stakeholders unanimously claim that this amount is vastly inadequate to achieve proper engagement and facilitation around an issue as complex as sanitation provision. It is worthwhile investigating how this social facilitation allowance in the subsidy amount is used, if at all. If a Community Approach to Total Sanitation is taken (see Community section), there will need to be more effort and resources allocated to the non-technical components of sanitation provision. The Human Settlements Capacity Building grant is available to build metro capacity to either develop engagement skills but is only available to the City of Cape Town and its use for this specific purpose is not guaranteed.

There appears to be potential for the non-government funding sources to be employed to fill this funding gap. There are viable options for donor-supported scaling up intermediary capacity and the Violence Prevention through Urban Upgrading (VPUU) is a good example of this. There is limited scope to use government funds to set up intermediaries, so external funding is necessary to prove the role and viability of intermediaries before they can provide services to government or channel state funding.

4.1.3 Institutions

What is the current respective role of Provincial Government, national departments and local government in the provision of sanitation services in the Western Cape, and how might/should these change?

Overlapping mandates of national government departments have caused confusion at municipal level about which national department to approach for what. The DWS regulates bulk water and sanitation provision, as well as minimum standards for sanitation services. It also is the transferring authority for some minor water and sanitation grants. The DCoG, via the WC DoLG, approves MIG applications and regulates its use, while the DHS, via the WC DHS, approves housing programmes, disburses the HSDG and regulates project implementation. The national DHS also transfers the USDG directly to the City of Cape Town and monitors its use. The technical regulatory function undertaken by DWS is not necessarily problematic, but the fragmentation of the funding streams and the reporting required to the various departments may be burdensome and confusing. There is a strong case for integrated funding and reporting, as has been proposed in a recent review of infrastructure Grants (National Treasury et al., 2014).

Institutional arrangements will be affected by the forthcoming human settlements policy revision and how informal settlement upgrading is conceptualised. Nevertheless, the mandate for provision of

20 Within the scope of this project, attempts to quantify the staffing costs of intermediaries were not successful as the organisations approached were not willing or able to provide the data. The exercise was complicated by the many different activities and programmes undertaken by these organisations.

sanitation sits firmly with municipalities, while the mandate for housing lies with Province, but with municipalities as implementing agents in most cases. It is therefore proposed that the Provincial role be focussed on accelerating the formal housing programme which is an essential component of the roll out of sanitation services. An additional role for the Province should be to provide training, support and capacity-building to municipalities around informal settlement upgrading in the manner currently offered by the NUSP. Funding for this type of support would have to come in the form of a capacity-building grant, similar to that provided to the metros, or from a reallocation of the human resources budget of the Province.

Municipalities would therefore be the main government stakeholder in any upgrading or provision of interim services. However, the role of local government needs to shift dramatically and the community paper indicates that international best practice requires a more even power relation between the municipality and communities than is currently the case in the Western Cape. Municipalities lack skills and capacity to engage with communities. This is a role that can be filled by intermediaries, with municipal officials playing more of a programme and contract management role. One of the critical success factors is agreement around the responsibility for funding and undertaking operation and maintenance of sanitation systems.

What are the relationships between these departments, and what structures are in place for efficient and effective interdepartmental planning and communication?

The Western Cape Government has a well-established set of intergovernmental forums and processes. The relative importance of the various forums depends on who the key implementing agent of the Game Changer will be. If it is the Province through the DHS, then the Transversal Management or Spatial Governance System is crucial, as well as the PCF for obtaining municipal cooperation. However, if municipalities are going to be the key implementing agent, as is proposed, then the role of Province is likely to be more one of support and thus the JPIs, District Human Settlement Forums and MIG Managers Forums will be of more importance. It is notable that technical support to municipalities for informal settlement planning and upgrading is coming from national government via the NUSP and not from the Province. This is possibly due to a lack of expertise in this field at a provincial level, but this is perhaps a gap that could be filled to implement the Sanitation Game Changer. If a NUSP-type competency was developed at a provincial level, the upgrading approach could be rolled out faster than is currently being achieved through the NUSP.

What institutional capacity exists and what would be required for the various intervention options?

The most sobering finding from the research is the statement made by Shisaka that “The governmental and non-governmental actor capacity to execute [informal settlement upgrading] in the Western Cape is coming off a very low base and expectations for a rapid scale up of capacity should be avoided”. (Shisaka, 2015:48). However, for informal settlement upgrading - and sanitation provision specifically - to be a success, this challenge will have to be faced: an increase in capacity is what is required if the proposed participatory approach is pursued.

Unfortunately there are only a limited number of intermediaries active in the Western Cape geographically focussed on Cape Town and their scale of influence is relatively small (but growing). There are eight known non-governmental organisations involved in the Western Cape and only three actively involved in upgrading 44 settlements at present. Existing intermediaries will need to be provided with the conditions to grow and new intermediaries will need to emerge through the creation of state- and community-driven demand for their services. Adequate resources are required to fund intermediaries and block committees.

What are the legal impediments to alternative models of delivery and how might these be overcome?

In terms of contractual arrangements there is more scope for the use of framework contracts for procurement of intermediaries and implementing agents. While there is some concern about the legal impediments to contracting intermediaries to provide sanitation services, Section 76 of the Municipal Services Act is rather permissive in this regard and intermediaries would be fulfilling the role of 'water services intermediary' as prescribed in the Water Services Act. An important consideration in the scoping of municipality-intermediary contracts is the need to provide intermediaries with sufficient flexibility in approach and solution to retain their independence from the state.

What are the alternative options for delivery and management?

A more detailed settlement-level institutional model is proposed under the Community section below.

4.2 Technology, innovation and regulation

What technologies are proven, and which ones need testing?

The WRC Sanitation Technology Protocol is undergoing testing and analysis of on-site household technologies, the results of which will be published in February 2016. There are a number of emerging sanitation technologies that will unfortunately not be market ready within the 5 year timeframe of the Game Changer.

The following key constraints have emerged from policy and current best practice:

- Chemical toilets and other systems that require regular maintenance (such as the Africa Sanitation composting toilet) are likely to be expensive in the long run due to the high maintenance costs.
- Communal blocks are a viable option in dense settlements but should be coupled with a full time care-taker service, as well as adequate security measures (e.g. lighting).
- Dry sanitation options such as VIPs and urine diversion toilets may be effective in lower density areas; but generally space prohibits the installation of this type of technology in informal settlements.
- Decentralised wastewater treatment works which can be operated locally do not solve the problem of space for reticulation and the treatment works themselves require space. There are also concerns about effective monitoring of the facilities.
- Low flush toilets reduce water demand and the cost of bulk services required still require sewers with normal falls and may increase the maintenance burden.
- Simplified sewers using small diameter sewers and laid at shallow grades enable cost saving and more flexibility in layout, but will have a higher maintenance burden. This technology would also require stronger advocacy/education around correct usage to be effective.

What are the regulatory barriers to alternative technologies?

The application of the National Environmental Management Act (NEMA) requires an authorisation for each treatment facility. If less than 2,000 kl of wastewater is produced each day, this may negate the requirement for a full EIA, but every installation will require a General Authorisation as a minimum. The requirement to prove effluent discharge means that emerging technologies may not have sufficient

evidence to support the principle of their design, which may become a sticking point with the regulatory authority if the technology is not well understood.

What are the social and political barriers to alternative technologies?

Regardless of density, some form of flush toilet is widely regarded as the aspirational target and should be considered in relation to water availability at the site, cost, and potential for connection to a new or existing treatment facility. The argument against waterborne services on the basis of increased water demand is weak, given the relatively low impact (1.4%) on current levels of water demand, high consumption in affluent areas and the lack of regulation and payment enforcement for use above the free basic level. The political agenda also means there is hesitance to promote anything other than flush toilets, regardless of settlement density.

What are the institutional barriers to alternative technology?

There tends to be inertia within government institutions (including design engineers) to pioneer alternative technologies. This may be driven by the development costs, or knowledge base of implementation and operational staff. Life Cycle costing and Value Engineering should be instituted and fee structures should be reviewed to disincentivise expensive technologies where practical.

Decentralised systems may require more local maintenance and improved institutional support, but the level of expertise required for this maintenance is likely to be less than for large centralised systems.

What are the links between technical options and land?

Where land tenure is not secure, there may be reluctance to invest in permanent infrastructure, such that sanitation facilities are provided on a communal or temporary basis.

Space availability in the house will dictate whether household sanitation is viable. Sufficient space is also required within a community to provide shared or communal sanitation facilities and / or decentralised wastewater treatment or non-waterborne sanitation processing facilities, but this can only be assessed on a case-by case basis.

What are the links between technical options and finance models?

Life cycle costs must be considered for all technology selections. Waterborne technologies may have a high capital outlay but low maintenance cost, whereas options like chemical toilets may have no capital cost (using a rental model) but have a high maintenance cost (but this may also be beneficial in terms of long term employment opportunities).

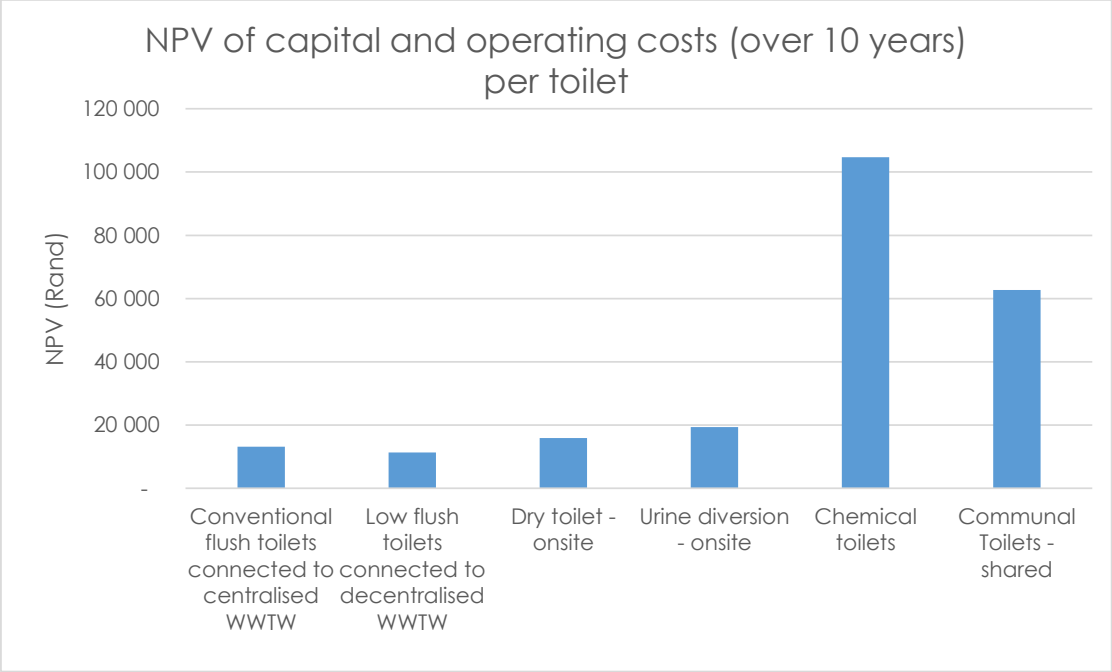


Figure 21: Life cycle costs for different toilet technologies*

*See Annexure 1 for costing assumptions

One chemical toilet has the same NPV as eight conventional waterborne toilets. The operating cost of communal ablution blocks is also relatively high, but the NPV is 1.7 times lower than a chemical toilet option (per toilet). The figure below shows that chemical toilets become the most expensive option after only three years. This would tend to indicate that even where settlements are temporary, if they are to remain for more than one year then options other than chemical toilets will be cheaper overall to the municipality.

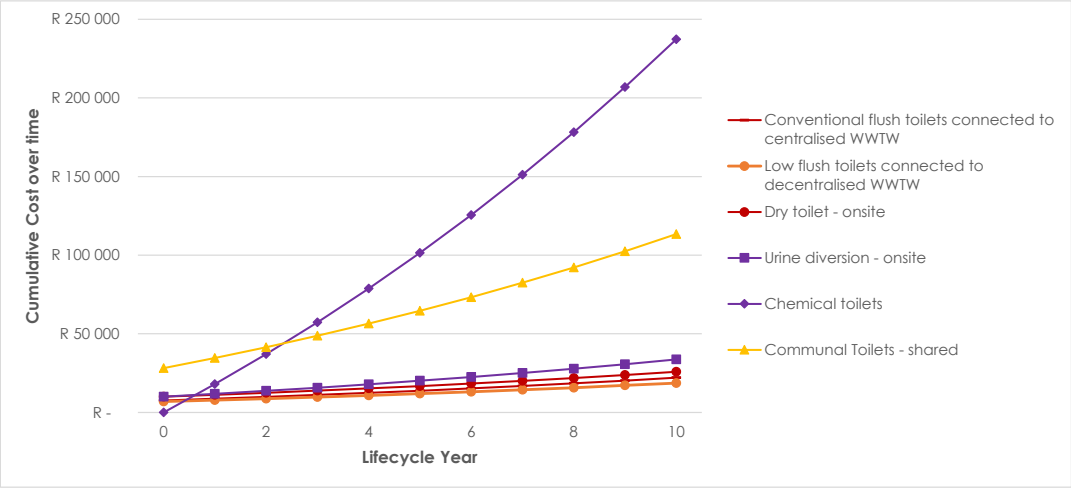


Figure 22: Cumulative cost of various technology options over time (not discounted)

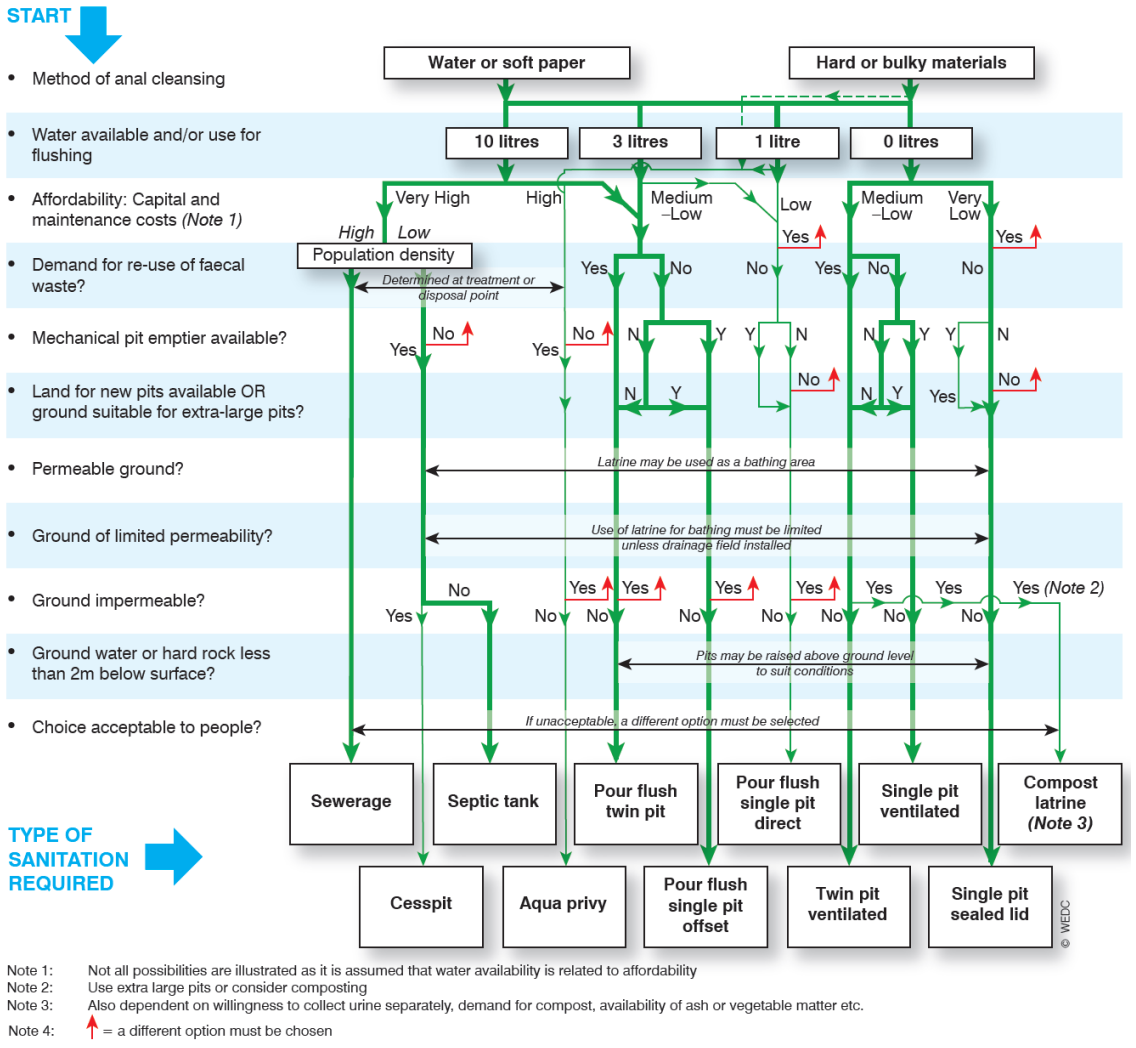
What are the economic opportunities arising out of technical options?

Different sanitation technologies will have different financial models attached, whether it is regular servicing of portable flush toilets, local maintenance of decentralised facilities, or beneficiation activities attached to the treatment process (productive use of treated effluent, nutrient extraction, gas production

etc.). Maintenance should not be provided in the form of short term opportunities but rather sanitation careers with consideration of the franchise model.

Recommendations

The selection of a particular sanitation technology is context specific and must take cognisance of multiple factors. A decision making matrix, such as that shown below, can be a useful tool to help inform the selection of a suitable technology for a given context. A similar matrix could be developed for the Western Cape, expanding on the technology options to include centralised, decentralised and ecological treatment. This matrix could be integrated with applicable GIS data to confirm proximity to bulk services, settlement density, soil conditions, topography etc. at a settlement level.



Note 1: Not all possibilities are illustrated as it is assumed that water availability is related to affordability
Note 2: Use extra large pits or consider composting
Note 3: Also dependent on willingness to collect urine separately, demand for compost, availability of ash or vegetable matter etc.
Note 4: ↑ = a different option must be chosen

Figure 23: Example decision matrix (Franceys, 1991)

This matrix should be developed with consideration of the Western Cape sanitation strategy. Some of the key criteria that would be required to develop the matrix.

Table 31: Sanitation matrix criteria

Criteria	Parameter	Significance
Settlement Density	Households per Ha	Determine space for services, access etc.
Population	No of people	Determine flow
Topography	Gradient	
Existing WWTW	Distance from Settlement Space capacity	Capacity and ability of works to receive effluent from the settlement. Inform cost of bulk services.
Effluent Discharge	To environment (General Special Limits) Irrigation Toilet flushing	Required treatment standard
Effluent Re-use	Irrigation (sports fields, golf course, agriculture) toilet flushing	Demand for reclaimed water or faecal sludge for fertilizer.
Water Supply	Municipal, Groundwater, Surface water	Availability of water for flushing
Ground Conditions	Soil type and depth	Suitability for infiltration, excavation of pits etc.
Acceptable Technology	Type of sanitation technology acceptable to residents	Technologies that would be accepted by the households / service provider

As settlement density reduces, dry sanitation technologies may become more viable, particularly where soil and groundwater conditions would permit infiltration. However, subject to the findings of the financial model, waterborne sanitation (in various forms) presents the most viable option for high density informal settlements, both for individual or shared servicing. However, these can only be implemented in conjunction with a treatment solution. The viability of decentralised treatment, versus centralised waste water treatment works will depend on space availability proximate to the settlement.

The incorporation of low flush or water recycling systems will reduce the potable water demand and size of bulk services. The opportunity to manage greywater together with providing waterborne sanitation is a further compelling reason to prioritise waterborne sanitation in high density settlements. Waterborne sanitation requires an accompanying solid waste management solution to eliminate blockages and misuse. Solid waste and stormwater interventions should be seen as complementary strategies to achieve the health and hygiene objectives of sanitation interventions, but also serve broader environmental objectives.

A strong case is made here for looking at alternatives to chemical toilets in informal settlements, even where these settlements are to be relocated. The table below provides a response to many of the arguments could be made in favour of chemical toilets.

Table 32: Arguments in favour of chemical toilets over waterborne options

Argument	Response
Chemical toilets are cheaper in the short term	Only the very short term (< 3 years)
Constraints to spending on infrastructure assets located on private land	This is a legally grey are that could be challenged (see previous discussion).
Perception of wasteful expenditure is a system has to be abandoned when relocation is required	It may be possible to depreciate the internal infrastructure over a very short time frame (e.g. 3 years) with the result that the assets have no value by the time relocation occurs.
'Permanent' infrastructure is perceived as implying permanence of a settlement, which may be seen as condoning the location of the settlement.	This is a matter of perception. The same perception does not exist for electricity and communal standpipes.
Chemical toilets can be installed very quickly	This is a valid argument. Design and installation of sewers in informal settlements is difficult and little experience of this exists and would need to be built. However, there are numerous international examples of this being done. The addition time required may be justified on other grounds.
Chemical toilets do not require a water or sewer connection	Another valid argument. However, most settlements have, or will have, a water connection, and calculations have shown that the additional water demand from flush toilets in informal settlements will be small.
´Interim' on–site solutions like chemical toilets may not require environmental authorisations.	The provision of waterborne sanitation is not necessarily a permanent solution and therefore may not need to have an environmental authorisation. A strong argument can be made that the provision of waterborne sanitation in informal settlements has a more positive impact on the environment than chemical toilets, which have detrimental impact on wastewater treatment systems.

4.3 Community

What are the community requirements from a participation view?

Community-based sanitation and the right to participate in public services have long been recognised in global development practice. Community participation has also been identified as a potential key lever for change in the Sanitation Game Changer process in the Western Cape. As international best practice, Community Approaches to Total Sanitation (CATS) recognise the role of community as 'leading the change process' and 'using their own capacities to attain their objectives' (see text box on CATS), which is synonymous with the more common concept of co-production.

Co-production implies that the end-users of a particular service are given the opportunity to determine the outcome and process of public service provision, and to utilise their skills. Moreover, co-production essentially shifts power to allow people to be integral in the delivery of their own services. However, direct involvement of local communities (particularly those living in informal settlements) in determining sanitation outcomes, managing sanitation facilities and monitoring sanitation provision is rare. Thus, a community-based sanitation approach requires a significant shift in the relationship between government and local communities, with implications for the role of the state, communities and potential intermediary organisations. This is captured in the notion of co-production.

The Essential Elements of Community Approaches to Total Sanitation (CATS)

1) CATS aim to achieve 100 per cent open defecation free (ODF) communities through affordable, appropriate technology and behaviour change. The emphasis of CATS is the sustainable use of sanitation facilities rather than the construction of infrastructure.
2) CATS depend on broad engagement with diverse members of the community, including households, schools, health centres and traditional leadership structures.
3) Communities lead the change process and use their own capacities to attain their objectives. Their role is central in planning and implementing improved sanitation, taking into account the needs of diverse community members.
4) Subsidies – whether funds, hardware or other forms – should not to be given directly to households. Community rewards, subsidies and incentives are acceptable only where they encourage collective action in support of total sanitation and where they facilitate the sustainable use of sanitation facilities.
5) CATS support communities to determine for themselves what design and materials work best for sanitation infrastructure rather than imposing standards. External agencies provide guidance rather than regulation. Thus, households build toilets based on locally available materials using the skills of local technicians and artisans.
6) CATS focus on building local capacities to enable sustainability. This includes the training of community facilitators and local artisans, and the encouragement of local champions.
7) Government participation from the outset – at the local and national levels – ensures the effectiveness of CATS and the potential for scaling up.
8) CATS have the greatest impact when they integrate hygiene promotion into programme design. The definition, scope and sequencing of hygiene components should always be based on the local context.
9) CATS are an entry point for social change and a potential catalyst for wider community mobilization.

Source: Adapted from UNICEF (2009) *Community Approaches to Total Sanitation: Based on case studies from India, Nepal, Sierra Leone, Zambia* , page 5.

Who are the stakeholders (NGOs and CBOs), what are their capabilities and where do they work/have they worked?

A survey of non-governmental actors was undertaken as part of the research for the Western Cape Human Settlements Framework (Shisaka, 2015). Although the survey related to informal settlement upgrading (ISU) and not sanitation specifically, the results presented in the table below are informative.

Table 33: ISU non-governmental actors (Shisaka, 2015:14)

ISU Actor type	**Non-government agency**
Developer/Co-developer/ Developers' Implementing Agents	• Development Action Group (DAG) • Community Organisation Resource Centre(CORC) • Aurecon
Investors	• SDI • Habitat for Humanity (Public infrastructure)
Target group	• Residents of the settlement in question, • CBOs representing the target group
Intermediaries or facilitators	• Community Organisation Resource Centre (CORC), • Development Action Group (DAG) • Aurecon • Ubuhle Bakha Ubuhle (UBU), • VPUU (public environment work streams only) • People's Environmental Planning (PEP). • Habitat for Humanity

Table 34: Positioning of actors in respect of ISU (Shisaka, 2015:14)

	DAG	**CORC**	**Aurecon**
Informal settlements currently on the organisation's books	33	9	2
Spare current capacity?	Yes	No	Yes
Willingness or plans to expand in ISU delivery?	Yes	Yes	Yes
Replicable methodologies and systems?	Yes	Yes	Yes

The Shisaka study also made the following conclusions around capacity (Shisaka, 2015:14):

- Two NGOs have the capacity to play a co-developer role with government in ISU namely DAG and CORC. In this co-development mode the municipality is required to deliver the Health and Safety/Emergency services and allied work processes, whilst the NGOs in coalition with the local CBO contribute inputs such as social development, tenure rights, layout planning/settlement planning, relocations or re-blocking, and project management.
- Engineering and other consultants have the capacity to act as an Implementation Agents in ISU.
- Two other NGOs, PEP and UBU, are in the process of assembling the capacity to become co-developers in ISU, whilst the remaining two are focussing on specific work processes within ISU.
- The NGOs and Implementing Agent with the willingness and capacity to gear up as ISU co-developers/IAs require a sustainable and appropriate funding model to do so.
- There is an obvious and significant capacity gap between non- governmental actor capacity to act as ISU developer/IA, and the ISU demand in the Western Cape

A survey and focus group undertaken specifically for the sanitation game changer with three of the organisations mentioned above (the Community Organisation Resources Centre (CORC), People's Environmental Planning (PEP) and Violence Prevention through Urban Upgrading (VPUU)) reached similar conclusions. The organisations employ a participatory approach to development, and emphasise co-production in their practice. All respondents focus on community-based planning and play a role in brokering between communities and the state. CORC and VPUU indicated that community capacity building is a critical aspect in their work, while PEP and VPUU engage in the physical upgrading of sanitation infrastructure. The three organisations have benefitted 18,900 households in the Cape Town and Stellenbosch areas. The key competencies of these organisations are the building of relationships between relevant stakeholders, setting up community networks, facilitating participatory planning processes and training communities to design, implement, maintain and monitor sanitation infrastructure. They have expertise in the built environment and offer technical support to communities.

What lessons can be learnt from best practice and poor practice?

The important lessons emerging from the community work stream focus group are:

- Mistrust between communities and the state poses a significant challenge to the implementation of community-driven sanitation provision
- Participation can take different forms, and the importance of these forms must be recognised
- Sanitation should be planned for and provided at a disaggregated scale
- An institutional model should be built on democratic principles
- Transparency about suitable options and limitations is essential
- Transformation cannot be achieved successfully without a political champion
- Adequate resource allocation is key to successful community-driven sanitation provision
- Communities must be capacitated in order to participate meaningfully
- Sanitation provision can serve as a catalyst for urban upgrading

What are the potential roles of intermediaries?

Intermediaries have a critical role to play in community-driven sanitation provision. Given the reality of severe mistrust between communities and the state, intermediary organisations are needed to negotiate partnerships between these stakeholders. These organisations are competent in capacitating communities, facilitating participatory planning, implementation and monitoring processes, and building relationships with various stakeholders. Further research is required to determine the availability of these competencies outside of the Greater Cape Town region. While smaller municipalities may manage relationships without the involvement of intermediaries, this can only be done where progressive officials take responsibility for fulfilling intermediary functions.

Recommendation regarding an institutional model to enable community-driven sanitation provision

The possible (and necessary) dimensions of such an institutional model for the Western Cape are as follows:

- An institutional model should support the creation of sanitation committees at a block level in settlements across the province
- These committees will serve as the interface between communities and the state, and must therefore be elected through democratic and locally determined processes
- The committees will be given the mandate to engage with the state about sanitation solutions, to come to decisions regarding the most adequate and appropriate solutions for their block, and to negotiate for the involvement of residents in the implementation and monitoring of services
- The state will provide block committees with a menu of options for sanitation solutions based on rigorous analysis of the characteristics of blocks within a settlement
- This menu of options will include detail regarding the costing of solutions, so that communities can determine their contribution to the process of service provision
- The proposed process will be linked to the existing Integrated Development Planning cycle

- Adequate resources will be made available to support the functioning of block committees, and block committees will be given discretion over a portion of the budget for service provision
- A provincial policy will be formulated to clarify the roles and responsibilities of stakeholders, and the institutional dimensions of the process
- Regular, structured engagement between block committees and the state will be set up from the outset and will be utilised throughout the various stages of sanitation provision
- Intermediary organisations will fulfil a support function by assisting communities in setting up block committees, assisting committees in analysing sanitation needs and identifying solutions, capacitating committees and ensuring accountability on the part of all stakeholders, amongst others. This role will need to be adequately resourced.

5 NEXT STEPS

5.1 Land, finance and institutions

The immediate steps proposed for each of the three sub-sections are:

Land

- The Rapid Appraisal of informal settlements being undertaken by the Western Cape Government will produce valuable information about hard constraints which should inform the Game Changer implementation plan.
- Engage National Treasury about the specific MFMA provisions and/or GRAP standards preventing servicing on private land.
- Test the existing legal opinion on the use of the Health Act to override the private land issue in a pilot case, if necessary.
- Municipalities to initiate expropriation processes for servitudes or transfer of land.
- Community-led re-blocking should be instituted as a first step wherever possible.
- Density of settlements should be controlled through enumeration and internal management by residents.

Finance

- Engage National Department of Human Settlements around changes to the HSDG grant framework that would allow for shifting of HSDG funds towards sanitation.
- Provincial Government should engage municipalities around the potential to prioritise grant funding (MIG and USDG) for sanitation and agree on targets and reporting formats for this shift.
- Lobby National Treasury for increased flexibility in capital grants, particularly MIG.
- Investigate and engage with National Treasury around the legal restrictions to a City Fund and pooled municipal funds.
- Engage with intermediaries around the proposed governance structure for managing a City Fund.
- Support intermediaries to access donor funding for capacity building and expansion.

Institutions

- Engage with the National Department of Human Settlements to inform the institutional arrangements of the new human settlements policy.
- Set up a Provincial Upgrading Support Programme (PUSP)
- Complete the database of informal settlement intermediaries active in the province.
- Develop Terms of Reference for intermediary and implementation agent panels with the view to establish framework contracts for multiple settlements.

5.2 Technology innovation and regulation

Moving toward realising the aims of the sanitation game changer would entail the identification of a suite of technology options for implementation. The following actions need to be taken:

- Assess the extent to which re-blocking can be applied to all settlements.
- Agree on service level targets for communal and shared sanitation.
- Develop a sanitation technology decision matrix with consideration of the Western Cape sanitation strategy and ensure that the data required to apply the matrix is available for all settlements.
- Understand connection and acceptance of supplementary portable flush toilets (PFT) and if such a system is provided, consider effective models for collection and disposal of this waste.
- Develop generic tender specifications for the installation of waterborne sanitation as an interim solution in informal settlements, including provisions for adequate engagement and participation.
- Develop a Blueprint for effective communal sanitation that is water efficient and incorporates provision for nightsoil disposal and personal hygiene (showers/baths). Consideration of caretaker model to be carefully considered.
- Confirm settlement density where waterborne sanitation is to be prioritised for connection to either a local decentralised WWTW or centralised WWTW (possibly via booster pump station).
- Confirm settlement density where dry sanitation will be considered, with careful consideration of the instruction and composting components required to support this infrastructure.
- Map location of settlements in relationship to topography and bulk WWTW to define the settlements which can viably be connected to bulk WWTW.
- Other settlements to be mapped according to their density and soil conditions to help prioritise technology selection.
- Engage with Provincial Treasury around the accounting treatment (depreciation) of interim waterborne sewer infrastructure.
- Engage with the WCG:DEADP around the need for environmental authorisation for the installation of interim waterborne sewer infrastructure.

5.3 Community

The following propositions were made at the community work-stream focus group:

- An institutional model should support the creation of sanitation committees[21] at a block level in settlements across the province.
- These committees will serve as the interface between communities and the state, and must therefore be elected through democratic and locally determined processes.
- The committees will be given the mandate to engage with the state about sanitation solutions, to come to decisions regarding the most adequate and appropriate solutions for their block, and to negotiate for the involvement of residents in the implementation and monitoring of services.
- The state will provide block committees with a menu of options for sanitation solutions based on rigorous analysis of the characteristics of blocks within a settlement.
- This menu of options will include detail regarding the costing of solutions, so that communities can determine their contribution to the process of service provision.
- The proposed process will be linked to the existing Integrated Development Planning cycle.
- Adequate resources will be made available to support the functioning of block committees, and block committees will be given discretion over a portion of the budget for service provision.
- A provincial policy will be formulated to clarify the roles and responsibilities of stakeholders, and the institutional dimensions of the process.
- Regular, structured engagement between block committees and the state will be set up from the outset and will be utilised throughout the various stages of sanitation provision.
- Intermediary organisations will fulfil a support function by assisting communities in setting up block committees, assisting committees in analysing sanitation needs and identifying solutions, capacitating committees and ensuring accountability on the part of all stakeholders, amongst others. These roles will need to be adequately resourced.

Further work (research and institutional design) is needed to determine the financial, institutional and policy implications of these propositions. It is beyond the scope of this paper to offer conclusive answers in this regard. However, based on international and local good practice there is enough evidence to suggest that making the shift to community-driven sanitation is not only the right thing to do (some would even say a necessity), it is also doable.

6 TOWARDS AN ACTION PLAN

The research can only conclude that the goal of providing one toilet per dwelling in every informal settlement in the Province is not achievable in the 2016-2020 timeframe. This is not to say that it should not be the goal, but its realisation will take time. The reasons for this are as follows:

- Insufficient institutional capacity in government to accelerate the housing programme and manage the scale of intervention required
- Insufficient funding with no immediate solution
- Insufficient intermediary capacity

21 These committees may deal with more than sanitation and the creation of space through re-blocking would also be a primary objective.

- Technical constraints in certain (few) settlements

Even if one had all the money, available land, appropriate technology choices and a well-designed institutional arrangement, the provision of sanitation in informal settlements will not roll out in a smooth, efficient and predictable manner. The timing of the process is fraught with politics and practical issues including:

- Varying community readiness and the time to organise communities to participate fully in settlement planning.
- Delays in land release, fund transfer and project approvals.

Given these realities, the implementation of a sanitation game changer would require the following trade-offs to be considered:

- Balancing the need to sustain funding for housing and other service delivery with the need to divert funding towards sanitation provision;
- Balancing household aspirations with the need for affordable solutions;
- Balancing the need to de-densify for certain technical options with the benefits of upgrading in-situ;
- Balancing the efficiency and cost of some technical solutions with the required maintenance and the skills and resources available to undertake this maintenance;
- Balancing the advantages of waterborne sanitation with the need to conserve water;
- Balancing a meaningful participatory process with the need to deliver at scale;
- Balancing the need for dedicated Provincial and municipal staff resources for engagement and implementation, with multiple competing tasks and shortage of funding.

The implementation of a 'Game Changer' implies a massive intervention at scale which is almost synonymous with a top-down approach. This is in tension with the empowering bottom-up participatory approaches that take time. The chasing of delivery targets is likely to discourage processes that may delay implementation, but which could also improve sustainability. As Pan et al state, "…part of the problem lies in the challenge of reconciling the pressure to deliver immediate results with a long-term vision to strive towards sustainable and equitable sanitation services." (Pan et al, 2015:1).

The two major challenges facing a community-led approach to sanitation provision are the deep-seated mistrust between communities and municipalities, and municipal resistance to community-driven processes as a result of a historical approach and thus a lack of skill in alternative modes, coupled with pressure to deliver. The Community Approach to Total Sanitation (CATS) focuses on the sustainable use of sanitation facilities and not the construction of infrastructure. This is in tension with the current state housing and municipal infrastructure programmes which focus on mass delivery of infrastructure. The treatment of households and communities as beneficiaries of state programmes and the associated expectations that this creates, militates against any alternative sanitation options and approaches.

The solution sought for a sanitation game changer is not a technical one. Some technical options are better than others in certain contexts, but any acceptable sanitation system can work if the conditions are conducive. Funding is not a primary constraint either, as some additional funding could be accessed or reprioritised and existing funding could be utilised more efficiently. It is the inability to create the correct conditions for the provision of a sustainable service that has been the downfall of sanitation

interventions in the past. Rather, the solution is an institutional and political one. The inability to solve the 'soft issues' has perpetuated the challenge of urban sanitation.

The 'Game Changer' should be about a break with the modus operandi of top-down infrastructure delivery towards a scalable process that delivers acceptable sanitation that is sustainable. To go to scale, participatory approaches require state funding. To be sustainable, state programmes need a participatory approach. What is required is not a 'solution', but instead resources, process and guidance.

The challenge, therefore is to agree on a process and institutional roles that maximise on existing capacities, while growing capacity both within municipalities and intermediaries to realise PSG 5. This will require a difficult shift in roles, whereby: municipalities bring authority, but cede control of resources to others in a partnership arrangement; intermediaries bring soft skills but develop more technical capacity; communities bring political power, but agree to collaborate with municipalities, and private sector players bring hard skills, but learn to appreciate that this is an inherently political process.

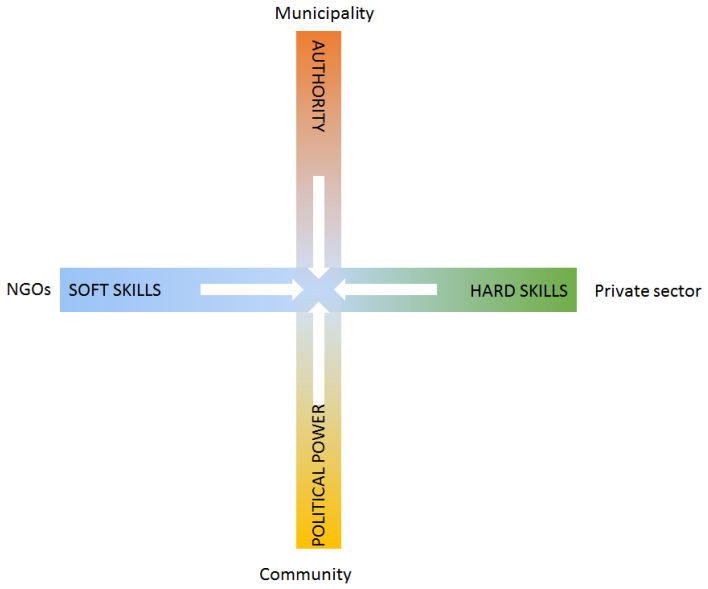


Figure 24: Required shift in stakeholder roles

This 'meeting of minds' is not only about skills, but also about funding and the governance arrangements around this funding. If the funding is structured correctly, then it can act as an incentive for the respective stakeholders to play their roles. Alternative funding models are possible, but much can be done with the available funding applied in the correct way.

The focus should be not on accelerating delivery, but streamlining the process of delivery through addressing the potential sticking points prior to implementation. This can be achieved through a well-designed CATS process that is intermediary-designed, community-led and state-supported. Planning cannot be centralised, but the management of resources and technical support can be.

Much depends on how the process interfaces with the housing programme. An important question is: should sanitation be provided independent of the housing delivery process? There are arguments both for and against. On the one hand, the methodology that is being proposed is an upgrading methodology that does not apply only to sanitation. On the other hand, sanitation is a strategic priority for the Provincial Government. The provision of housing and services through the national housing

programmes is essential to address the sanitation challenges, but the analysis illustrates that the provision of formal housing alone will not address the sanitation issue by 2020. Where an entire settlement is not being created or upgraded through a formal housing programme, there is a need to de-link the provision of sanitation from the housing programme to disrupt the current paradigm and expectations and to create the space (physical and institutional) for innovative solutions (that are nevertheless safe, dignified and sustainable). Households provided with sanitation in this way must not be excluded from the national housing programme.

There is no technical solution or generic scalable approach to informal settlement sanitation. There is, however, the potential to shift the approach and to divert resources to sanitation as an entry point into informal settlements to catalyse broader change. In picking the target and approach one needs to measure the scale of benefit, not the scale of delivery. The benefit is measured in terms of the overriding objective of sanitation provision, which is *ongoing* health and dignity.

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ANNEXURE 1: METHODOLOGY

The project is separated into three project phases. Phase one ('Status quo and options analysis'), completed in November 2015, involved quantifying the problem and the realms of possibility through:

- An inception meeting;
- Desktop data collection;
- Analysis of data;
- Interviews with key stakeholders;
- Drafting of presentation;
- Presentation to the project steering committee

Phase two involved support to syndicated work across three core work-stream themes which emerged from the May 2015 Design Lab, specifically:

1. Land, Finance and Institutions;
2. Community;
3. Technology, innovation and regulation.

This report represents the combined results from Phase one and Phase two of the study.

The final section of this report provides a synthesis of how these results can be taken forward by the Western Cape Government in phase three of the study in working towards an action plan.

Analysis and modelling approach

The analysis and modelling approach entailed the compilation and analysis of a range of datasets to inform a baseline understanding of the status of sanitation access in informal settlements in the Western Cape. Based on this baseline, at least two core scenario analyses were undertaken: that of a Business as Usual relative to a 1:1 target of sanitation access.

Datasets used

The following datasets were made available to the study team and were utilised in the data and modelling analyses:

- Western Cape Informal Settlement Database 2014;
- National Upgrade Support Programme (NUSP) Database 2015 with records for a selection of local municipalities, namely:
    - Stellenbosch
    - George
    - Theewaterskloof
    - Drakenstein
    - Mossel Bay

- Housing Project Pipeline Databases for district municipalities, specifically:
    1. West Coast (May 2015)
    2. Cape Winelands (October 2014)
    3. Overberg (August 2014)
    4. Central Karoo (September 2014)
    5. Eden (July 2015)
- Extract from the City of Cape Town Informal Settlements Database 2014;
- City of Cape Town Informal Settlement Development Matrix (NUSP) Database 2015;
- City of Cape Town Informal Area Upgrade Programme 2014/15 – 2018/19;
- City of Cape Town Water and Sanitation (Informal Settlement Unit) Asset Register (October 2015);
- Western Cape Infrastructure Framework 2014;
- Western Cape Water Supply System Reconciliation Strategy produced by the Department of Water and Sanitation (October 2014), and
- Statistics South Africa's Census 2011 dataset.

Dataset challenges and responsive modelling assumptions

In undertaking the analysis exercise, a number of data challenges were encountered in terms of data incompleteness, inconsistency, inadequacy and/or lack of clarity or comparability of information. To remedy these, a number of modelling assumptions had to be made. The table below outlines the key challenges and the corresponding modelling assumptions then made.

Table 35: Dataset challenges and remedial modelling assumption

No.	Data challenge	Modelling assumption
1	UISP: Data gaps made this difficult to reconcile.	From 2017 onwards, assume that the average rand value of funds allocated through UISP between 2014-2016, continues.
2	Inconsistency in housing pipeline information on how much of the total housing funding is allocated to informal settlements (IS).	Assume that **70%** of all housing funds is allocated for housing programmes in IS.
3	Depending on dataset used (Census or municipal IS count), there is inconsistency in the results in terms of what the percent growth in IS households has historically been.	Assume an annual average growth rate of the number of IS households of **5%.** Further assume this growth rate remains constant up to 2020.

4	It is not clear how the sanitation backlog corresponds to the current housing backlog.	Assume that the percent of households subject to a sanitation backlog is the same as the percent of households subject to a housing backlog.
5	NUSP data only available for a subset of local municipalities.	Assumed that additional projects will be undertaken based on base year NUSP backlog proportional split between NUSP categories.

Key growth, technology, costing and consumption assumptions

To enable the projection of the demand and supply of sanitation to informal settlements in the foreseeable future, a number of qualifying assumptions had to be made. These include:

- Baseline year: 2015
- Modelling time horizon: 2015 - 2020
- Growth in informal settlements: 5% per annum from the baseline
- Additional (sanitation) units to be delivered assumed to be influenced by an assumed increase in delivery per year as follows:
    - 25% in 2016;
    - 75% in 2017;
    - 100% in 2018;
    - 125% in 2019, and
    - 175% in 2020.
- Sanitation backlog in informal settlements was calculated as the difference between households unserved at 1:1 and households impacted by UISP and housing delivery

Further to this, the additional opportunities required to eliminate the sanitation backlog were assumed to be a function of the baseline split of projects according to the NUSP categories (which are described later in the report). Corresponding to each NUSP category was a set of proposed sanitation technologies, as follows:

- A: Conventional flush toilets connected to centralised Waste Water Treatment Works (WWTW);
- B1: Waterborne sanitation once barriers have been removed;
- B2: Chemical toilets;
- C: Relocate and provide for waterborne sanitation.

The costing assumptions which then corresponded to the array of sanitation technologies were then as follows[1]:

Table 36: Assumed capital costs

Sanitation technology	ZAR/toilet
Conventional flush toilets (toilet, structure and wash stand) connected to centralised WWTW [applicable to A1, A2 & B1]	R 7 632
Low flush toilets connected to decentralised WWTW	R 6 900
Dry toilet - onsite	R 10 000
Urine diversion - onsite	R 10 000
Chemical toilets [applicable to B2]*	-
Communal Toilets - shared	R 28 158
Land [applicable to C - Based on housing subsidy quantum]	R 6 000

*Note: It was assumed that all settlements classified as B2 in terms of the NUSP categories would receive a chemical toilet which is usually hired and thus do not have a capital cost attached.

Table 37: Assumed operating costs

Sanitation technology	ZAR/toilet/annum
Conventional flush toilets connected to centralised WWTW	R 1 095
Low flush toilets connected to decentralised WWTW	R 894
Dry toilet - onsite	R 1 200
Urine diversion - onsite	R 1 800
Chemical toilets	R 18 000*
Communal Toilets - shared	R 6 469

**Chemical toilet cost taken as an average of costs provided by the City of Cape Town and eThekwini municipality of R1 500 per toilet per month.

Table 38: Bulk sanitation costs

Bulk sanitation costs	
Bulk and connector sanitation cost (Rand/million/Megalitre/day)	R17
Total conventional toilet bulk cost (Rand/toilet)	R1 632
Total low flush toilet bulk cost (Rand/toilet	R 900

In addition, a number of assumptions related to household water consumption and communal toilet usage were made, as follows:

Table 39: Water consumption per user

Water consumption per user	
Number of flushes per day per person	4
People per household	4
Total flushes per day	16
Conventional toilet volume per flush (litres)	6
Low flush toilet volume (litres)	2
Total conventional volume discharged per household per day (litres/day)	96
Total low flush volume discharged per household per day (litres/day)	32

A number of assumptions were also made with specific reference to water demand in the City of Cape Town, including those as outlined in the table below.

Table 40: City of Cape Town water demand assumptions

City of Cape Town (CoCT) water demand assumptions	
CoCT Water demand (2013/14)	
Million m3/annum	307
Ml/day	840
Future water consumption drivers	
Number of households unserved at 1:1 in informal settlements	107 058
Additional water consumption due to flushing (l/household/day)	125
Additional water demand (megalitres/day)	13

ANNEXURE 2: TECHNOLOGY OPTIONS

A number of user interface and treatment sanitation technology options exist. Each has a number of pros and cons. These are unpacked in Table 41 and Table 42.

Table 41: User interface technology options

Categorisation	Description	Technology options	Advantages	Disadvantages	Constraints
Conventional Flush Toilets	Conventional flush toilet using approx.. 6 litres of water per flush.	6 litre conventional 4&6 litre dual flush Manual / VariFlush (flush only as long as the user presser the handle)	Has a water seal for odour control and can be installed in the home. Aspirational for most HH.	Requires secure water connection	Requires connection to sewer or onsite treatment
Low Flush Toilets		Pour Flush (1 litre manual) EaziFlush (2 Litre) Arumloo (1.5 Litre) (prototype stage only)	Has a water seal for odour control and can be installed in the home. Can flush with Greywater.	Requires water source.	Requires connection to sewer or onsite treatment
Dry Toilet		EcoSan Enviroloo Biomite	Does not require water or sewer connection	Usually installed out of the home. Dry waste needs periodic disposal	Requires dry waste handling facility
Urine Diversion Toilets	Urine is diverted away from the faecal waste	Can be used with Flush Toilets but usually used with Dry toilets.	Does not require water connection or connection to WWTW.	Need to sit to capture urine (unless separate urinal included). Faecal contamination of UD	Require urine collection or infiltration.
Chemical Toilets	Waterless toilet that sometimes has a low volume chemical flush for odour control and digestion	Mshengu Sanitech Boland Etc.	Rapid implementation and maintenance sub contracted out.	Expensive to operate, can have unpleasant odour. Sometimes use hazardous chemicals (Formaldehyde)	Short term only Require truck access for maintenance.
Shared Toilets	Typically 5 households share access to a toilet and will usually secure the toilet with a padlock	Usually Precast Concrete (panels or single piece)	Can be located closer to home and shared HH will take better care of the toilet.	Requires good relations with shared users	If waterborne needs connection to sewer
Communal Toilets	A communal toilet block that has several toilets (usually 6 to 10) that anyone can use. Often coupled with tapstands & clothes washing area	Kayaloo (toilets only) Ethikwini CAB (includes showers) MobiSan (dry sanitation)	Can provide hub for other services. Suitable in dense settlements where there is not space to put toilets in the house.	Requires block of space for the facility (3m x 8m min).	Requires connection to suitable treatment / disposal facility

Table 42: Treatment technology options

Categorisation	Description	Technology options	Advantages	Disadvantages	Constraints
Centralised	Waterborne sewerage connects toilets to a large centralised Wastewater Treatment works	Conventional WWTW design	Central facility can be easily monitored and managed	Requires bulk sewer connections and booster pump stations. Not energy efficient.	Requires and EIA, energy and expert operators
De-centralised	Waterborne sewerage connects toilets to a local treatment facility	Passive low energy ecological treatment. Package plants. (Maskam etc.)	Energy efficient, creates local jobs. Plants less than 2Ml /day may not require EIA.	Requires co-ordinated monitoring and maintenance for remote plants	Space required for facility (approx. 5m2 per user)
On-site DRY	Self-contained sanitation technology that does not require water for operation	Afrisan Batho-Pele Bio Mite Enviroloo	Do not require water Enables recovery of nutrients / compost. Do not require electricity	Usually have odour issues and low user acceptance.	Requires facility for disposal and further composting of waste
On-site WET	Self-contained sanitation technology that uses flush toilets (low flush or conventional toilet may be connected to these systems)	Bubbler WetLoo ETE Solutions Smartsan Waste Intrique	Systems include re circulation of water for flushing, and therefore do not usually require mains water connection	Require secure electricity supply or solar panels for reliable operation.	Effluent disposal must reach general authorisation limits.
On-site EMERGING Technologies	New technologies that use chemical treatment processes in place of conventional biological processes.	Bill and Melinda Gates Reinvent the Toilet (Various) AndyLoo (incinerator)	Promote capture of energy and nutrients.	Technologies do not benefit from long term field testing.	Mostly very technical solutions that will require expert maintenance