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Ngunjiri, Irene Wanjiru

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WATER GOVERNANCE IN URBAN INFORMAL SETTLEMENTS: AN INFRASTRUCTURE LENS PERSPECTIVE ON MUKURU, NAIROBI AND KYA SANDS, JOHANNESBURG

IRENE WANJIRU NGUNJIRI

A dissertation submitted to the Faculty of Engineering and Built Environment, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy.

January 2022

DECLARATION

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

Part of this thesis has been presented at the:

SIID 9th Annual Postgraduate Conference, University of Sheffield, United Kingdom, April, 2018. Modes of Everyday Water Governance in Informal Settlements in Developing Countries: A Literature Review.

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(Signature of candidate)

(Date)

ABSTRACT

Through an extended notion of infrastructure as constituted of materials, people (human bodies and social relations) and knowledge, the study explored the diverse elements of infrastructure that residents of informal settlements have to navigate for continued access to water services as well as how the navigation transforms the normative mode of governance of access towards non-normative modes. The study employed a qualitative and comparative case-study approach based on everyday practices in access to water services in the informal settlements of Mukuru (in Nairobi, Kenya) and Kya Sands (in Johannesburg, South Africa). Primary data (from interviews, focus group dialogues–FGDs and transect-walks for direct observations) were combined with secondary data for thematic analyses guided by *Atlas ti* coupled with matrix-based data coding approach.

Emerging from the extended infrastructure lens coupled with point-of-access manoeuvres, the study contributes towards urban governance discourse through a deepened understanding of how access to water services in informal settlements is mediated through an *assemblage* of human and non-human elements of infrastructure. Overall, the study demonstrates how unwarranted privileging of the "expert" through biasing of formal policies and practices towards normative modes of water governance fails to gain traction on the ground, especially when contested through diverse manoeuvres of everyday practices which transform the normative to non-normative modes of governance.

One of the most salient insights of the study is the elevation of the critical role of *people-as-infrastructure* (in terms of the human body and social relations) in access to water services. Specifically, the study reveals diverse embodied intersectionalities (such as by race, gender and class) of people-as-infrastructure with regard to access to water services especially in the last-mile delivery to residents' houses. The study further extends the understanding of Simone's notion of people-as-infrastructure where it primarily translates into *women-as-infrastructure.* Given the ongoing racial inequality in post-apartheid South Africa, the understanding of *women-as-infrastructure* is further intersected by race to form the *'black-female-body'* as infrastructure in the case of Kya Sands. The people-as-infrastructure element thus opened up avenues for non-normative manoeuvres such as contestation/subversion of rules and tampering with material infrastructure by actors in order to ensure access. The study thus foregrounds the perpetual "visibility" of material hydraulic infrastructure in informal settlements contrary to Heidegger's argument that infrastructure is only visible when it breaks down. Through the knowledge component, the study demonstrates how the normative mode of governance gets inverted/subverted when state officials resort to the situated knowledge of residents to accomplish diverse management roles such as repairs of the material infrastructure where infrastructural knowledge by men becomes more visible as the critical infrastructure element.

Key Terms: access to water services, assemblage, everyday practices, non-material infrastructure, non-normative mode of governance, people-as-infrastructure, state abstinence and absence

DEDICATION

This work is dedicated to my beloved parents, my number one cheer leaders;

Mr. Naftali Wanjohi Ngunjiri and Mrs. Jane Wanjiku Ngunjiri

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LIST OF ACRONYMS AND ABBREVIATIONS

CBD	Central Business District
CoJ	City of Johannesburg
CGN	County Government of Nairobi
CPR	Common Pool Resources
FGD	Focus Group Discussions
IDRC	International Development Research Centre
JW	Johannesburg Water Company
NUA	New Urban Agenda
NWSC	Nairobi Water and Sewerage Company
NRW	Non-Revenue Water
SDG	Sustainable Development Goal
SPA	Special Planning Area
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
Wits	University of the Witwatersrand

CHAPTER ONE

1 BACKGROUND AND MOTIVATION OF THE STUDY

"The water crisis is largely a crisis of governance" Organization for Economic Cooperation and Development (OECD, 2011:1)

1.1 BACKGROUND TO WATER GOVERNANCE

In February 2017, I found myself engrossed in deep conversation with KK, an employee of *Muungano wa Wanavijiji,* which is the Kenyan Federation of Slum Dwellers founded in 1996. KK had been working in the organization since its inception. Both of us were part of a consortium commissioned by the County Government of Nairobi (CGN), to conduct a situational analyses of basic services provision in Mukuru informal settlement. The study was motivated by persistent protests by residents about the lack of services. As we walked through the settlement, I was puzzled by the dire situation and the "state of hopelessness" that I was witnessing. Besides, there were numerous plastic water pipes running throughout the settlement which the team members had to look out for so as not to trip. Around various water points there were queues of people waiting in line with yellow jerricans to purchase water. The conversation began when I asked KK how the situation had become so deplorable. KK began explaining to me about the service delivery woes in the settlement and at some point, he looked at me and lowering his voice said, "it's the cartels". He noticed the blank expression on my face and began to explain, "You see the cartels are like the mafia. They are like the government of this place and control access to basic services especially water. They determine who gets water, where, when, at what cost and frequency". This comment left me questioning how residents in informal settlements such as Mukuru secure basic services. I wondered, do the residents have other options for water access apart from the "mafia"? How do they cope with inadequate water services in their homes? How do they manoeuvre life in the city in the absence of such a crucial service for survival?

The struggle to access water in informal settlements is one that resonates with an increasing number of people not just in Kenya but globally. Contemporary debates recognize that water availability or scarcity is less fundamental than the question of governance (Future Directions International, 2020; OECD, 2011; Bjorkman, 2015). Many people in cities of the Global South have no access to water despite having enough water because power relations influence who has control and access to water services as well as who is

excluded from gaining access (Swyngedouw, 2009). In broad terms, water governance is defined as "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall, 2003:7). This definition elucidates the various components of water-related decision making. While all these components are important and interrelated, this study focuses on the political dimension of water governance which emphasizes equal rights and opportunities in decision-making especially with regard to access to resources. Power relations and political interests ultimately influence who gets access to water. In addition, Bakker and Morinville (2013) argue that the political and institutional dimensions of water governance have been overlooked in prevailing discussions on water access and yet they are an important part of water governance. The study analysed the formal and the everyday practices and negotiations of water access, use and disposal of denizens in informal settlements.

Schwartz, Tutusaus, Rusca and Ahlers (2015) argue that water provision in urban areas is characterised by the existence of a range of modes of formal and informal water governance processes which are interlinked, mutually constitutive and create a labyrinth of water services provision systems. For instance, in informal settlements, formal elements such as application to the utility for a water connection and a service contract coexist with informal elements such as illegal connections for the same water. Thus, the web of water service provisioning systems is coproduced by various actors who interact through various infrastructure to access, control and distribute water services. Further, given the relative inadequacy of formal infrastructure in informal settlements, examining the formal aspects only provides only a partial understanding of water services provision and how things operate (Lawhon et al., 2014).

Using extended notion of infrastructure as constituted of materials, people (human body and social relations) and knowledge, this comparative study endeavoured to compare how residents (who also constitute the infrastructure) in two informal settlements - Mukuru, Kenya and Kya Sands, Johannesburg, navigate and manoeuvre access to water services in a context of relative water scarcity. Intersectionalities in Simone's (2004) notion of *people-as infrastructure* (human body and social relations) with regard to access to water services remained as the focus issue of the study. Specifically, the study argues that, in reality, within informal settlements, the notion of people-as-infrastructure is largely women-as-infrastructure. Further, in the context of post-apartheid South Africa, the black-female-body is a predominant part of the hydraulic infrastructure.

This chapter begins by presenting the motivation for attention on access to water services in informal settlements coupled with the conceptualization of the notion of water access as applied in this study. The problem statement, the research questions and the initial hypothesis are then articulated. Finally, the chapter presents an overview on the research strategy as well as the structure of the thesis.

1.2 ACCESS TO WATER SERVICES IN INFORMAL SETTLEMENTS

Several reasons motivated for the attention on water services in informal settlements based on an everyday-practices approach. Firstly, the New Urban Agenda states that the proportion of people living in informal settlements in cities of developing countries is high and is predicted to continue growing (UN, 2016). It is estimated that 30% to 60% of the urban population in the global South live in informal settlements (Mitlin and Satterthwaite, 2013). In many of these cities, the majority of the urban dwellers do not have adequate water services, and the problem is further compounded by their lack of voice and influence (Olumuyiwa, 2016). Yet, informal spaces are both the result of visible links to the formal city as well as the social-political processes by the residents, among other actors (Kornienko, 2013).

Secondly, although informal settlements provide temporary solutions to the consequences of rapid urbanization, they should not be viewed as sustainable options for the urban poor (Rocco and Ballegooijen, 2018). This is because residents of informal settlements are socially and economically disadvantaged while also being exposed to environmental hazards. Inadequate water services therefore only aggravate their situation by making them more vulnerable to exploitation (Olumuyiwa, 2016). While the residents are often excluded from access to services and other benefits from the state, such exclusion often serves as a call for them to devise coping mechanisms in order to increase their resilience.

Thirdly, measures of water access based on the number of pipe connections fail to consider that the number of connections does not always translate to clean and potable water or functioning connections (Peloso, 2014; Satterthwaite, 2016). Besides, statistical measures do not reveal how the number of connections impact the daily reality of urban households in informal settlements regarding water access. Further, using the number of connections to infer access to water services fails to distinguish between enabling infrastructure versus functioning infrastructure. Enabling infrastructure is the presence of the infrastructure required to circulate water (Eales, 2009). On the other hand, functioning infrastructure is infrastructure that is working properly and thus delivers water services as and when required. This distinction is important

because mere presence of infrastructure does not reveal the experiences of residents in accessing potable water (Peloso, 2014; Satterthwaite, 2016).

Likewise, statistics of connections do not indicate the extent to which the right to water is progressively attained by people who previously did not have access to water services (Dugard, 2016). Besides, aggregate statistics often hide the spatial disparities in access to water services due to political and geographical positioning. Aggregate statistics camouflage the number of unconnected residents and the costs the urban poor incur to obtain water. For example, these measures do not reveal how the number of connections impact the daily reality of the urban households in informal settlements who often have to rely on alternatives such as water tankers, water vendors or communal taps serving multiple households to meet their daily requirements of water.

Equally, the rural/urban binary categorization makes the realities of informal settlements invisible by coding them as rural or urban during statistical analysis (ibid.). Lawhon et al., (2014) argue that pipe connections tell us even less about the realities of those who are outside the supply grid, as is the case with most households in informal settlements, and how they manage with the meagre amounts of water that they access by whatever means or practices they devise. Moreover, the presence of legislations promulgating universal access to water (the Water Services Regulation, 2001 and the Water Act, 2016 in South Africa and Kenya respectively) does not necessarily translate into reality in practice.

1.3 CONCEPTUALIZATION OF ACCESS TO WATER SERVICES

In their effort to access water services, residents in informal settlements need to navigate uncertainties caused by irregular water availability. This study examines how such access to water services amidst irregular supply is mediated by both human and non-human elements of infrastructure. Although access is a multidimensional term, I hypothesise access along the proximate and the processual dimensions in line with Ranganathan and Balazs (2015) where the proximate dimension refers to the quality and quantity of water available while the processual dimension refers to the multi-layered power relations that allow people to obtain benefits from water. I find this explanation useful because a focus on both dimensions provides a more comprehensive view of water governance given that everyday practices are a form of governance and hence both become inseparable and interrelated. This study thus analysed not only the “microspheres of negotiation” in informal settlements for water access, use and disposal by households but also some inherent

attributes of water such as quality and quantity (Gandy, 2008:125). The analyses of the microspheres of everyday life brings out the fact that informal settlements are "places of bargaining between the formal and the informal, the legal and illegal that define the struggles of everyday life" (Kornienko, 2013:175). Equally, households are spaces where individuals have different interests, preferences and unequal power relations which determine individual household members' access, use and disposal of resources (Button, 2017). Therefore, navigating access affects both inter-household and intra-household relations as people secure and compete for a scarce resource which shapes the "power relations in everyday life" (Velzeboer et al., 2017:2).

In a paper titled '*A Theory of Access'* Ribot and Peluso (2003) point out that access entails a bundle of powers that enables actors to gain, control and maintain the accrual of benefits from a resource. The paper has been regarded as instrumental in extending the notion of access beyond a bundle of rights to include social and power relations involved in deriving benefits from resources (Myers and Hansen, 2020). In order to assess how resources are accessed, the processes and relations employed by actors to derive benefits must be interrogated. In other words, the beneficiaries of the resources must be identified as well as the means that they rely on to obtain and sustain benefits from the resources. Further, the modes of accessing resources are constantly (re)configured since power relations changes in a similar manner to the sources of power (ibid.). Thus, access is best understood through investigating who, how and by what means people derive benefits from a resource.

Access to, use and disposal of water are influenced by interhousehold and intrahousehold power relations. This study conceptualises power as diffused and dispersed, and in turn influences the actions and decisions related actors (Lawhon et al., 2014). This understanding of power as being diffuse and layered enables the analysis of "…power at work in subtle relations between actors through the sources of power they deploy to unveil how everyday hydraulic practices reproduce unequal access to water" (Velzeboer et al., 2017:3). Additionally, it allows us to go beyond binaries and reflect on intersectionalities such as age, gender, social and political connections in power relations which are critical in this study (Cornea, 2016; Harris et al., 2016). Given that access to water is both a physical and political process, the distribution of water reveals the power of actors as well as the networks within a particular space (Bawa, 2011; Ranganathan and Balazs, 2014).

Access, particularly in the global South, is continually (re)negotiated between actors at different spaces and time using various tactics and practices (Cornea, 2016). Ribot and Peluso (2003) theorize that while some actors gain control of resources others access resources through those who exercise control over the resources. This argument is important in explaining the reasons why some actors benefit from resources with or without rights to the resource since access analysis goes beyond property rights since access can be achieved 'outside' of the prevailing law and regulations. Given that the webs of power are (il)legible, a distinction between the control and maintenance of resources gives a nuanced understanding of access to resources. An actor controls access to resources when he mediates access to them while maintenance is exercising power in keeping access to resources open through deploying other resources as well as exercising power. Additionally, actors mediate access to water services through both human and non-human infrastructure.

Importantly, in the African context, the colonial or apartheid legacies that influenced both the power relations between and among different actors as well as the physical infrastructures created inequalities in service provision and continue to shape the everyday experiences of access to services (Distretti, 2020). Many countries in the global South such as Kenya and South Africa have declared universal access to water services as a basic human right (see detailed discussions in Section 4.3.1 and 6.3.2). This right is premised on the non-substitutability of water as well as the fact that many other human rights are predicated on access to water services (Dugard, 2016). However, in spite of the right being legislated, inequalities in access to water services persist and at the same time, these same countries commodify water by turning it from a public good to a commodity that is subject to market forces (ibid) (see detailed appraisals of studies on access in Chapter 2).

1.4 INFRASTRUCTURE AND EVERYDAY PRACTICES

This study interrogated how governance is mediated through infrastructure by examining how residents and other actors engage infrastructure to access water services in informal settlements. The use of the infrastructure lens to analyse governance is gaining traction in scholarly work to make explicit the nuances of the everyday experiences of residents in gaining and maintaining water access, use and disposal and the complexities inherent in everyday life within contemporary urban spaces (Graham and McFarlane, 2015) (see detailed review of studies on theory of assemblages in Section 2.3).

Water is a multi-layered and complex field of social, material, economic, legal as well as human rights concerns that are driven by the materiality of water itself and the technological requirements such as pipes and pumps (ibid.). Given that the material is a constitutive of how people engage the state, negotiations of urban residents over overt and covert properties of infrastructure are often intense and contentious (Wafer, 2011). Everyday practices produce infrastructure that is unequal, political and fluid, while at the same time, material/technical infrastructure configures everyday practices (Anand, 2015). Hence, infrastructure has gained prominence in political inquiry given that it enables or threatens everyday life with regard to access to water services (Meehan, 2014).

Examining how the hydraulic infrastructure is structured by the residents and how, in turn, the infrastructures structure the behaviour could reveal how power struggles crystallize in the process of accessing water services. Everyday practices reveal the lived materialities and realities of residents in navigating inadequate hydraulic infrastructure and thus deepen the understanding of politics outside the realm of formal (normative) urban governance (Graham and Mc Farlane, 2014). Since infrastructures are dynamic, interrogating infrastructure should consider "their accretion and accumulation, their cracks and their fissures and the politics of their present and future" (Barry, 2015: unpaginated). Effectively, the past, current and future politics are (re)constituted since inadequate supply of water services leads people to maneuver the system to gain access to water by alternative means (Ahlers et al., 2014:2). For instance, in South Africa, the past politics of apartheid and how it configures infrastructural inequalities in the post-apartheid city has led to persistent inequalities in access to water services.

Based on a study of the confluence of infrastructure and practices in the global North, Shove (2016) argues that a study of infrastructure can reveal the overlays in the conjunctions of infrastructure and practices and so form the basis for the construction of various practices while allowing multiple practices to take place at once. The co-evolution between infrastructure and everyday practices occurs in complicated and contested ways whereby infrastructure produces everyday practices and everyday practices generate infrastructure (ibid.). For instance, infrastructure may fail to generate the anticipated practices while some practices may persist in spite of the lack of infrastructure. Thus, a nuanced understanding of infrastructure calls for thinking beyond the material dimension to a more dynamic non-material sense of infrastructure to reveal the mutual co-constitution of everyday practices and infrastructure at different spaces and time (Shove and Trentmann, 2018).

1.5 IDENTIFICATION OF THE KNOWLEDGE GAP

The knowledge gap addressed in this study was initially identified through my direct experience of the water services-access situation in Mukuru which provoked a need for the study (see Section 1.1). Later, I engaged with theory in search of explanations for what I had experienced directly. The gap that I identified in the theoretical explanations and my direct experience constituted the motivation of the study. In other words, both the direct experience and the theory guided the formulation of the research question of this study. Table 1. 1 captures the key contextual provocations that I experienced in Mukuru, how the provocations are understood and explained in literature, how the knowledge gap which motivated the study was arrived at in order to facilitate the original contribution of the study.

The body of studies which informed my research aligns with calls to investigate the "informal social modes of interaction which operate with logics that are often autonomous to those of the state" but affect the governance of water services (RSA, 2003:9). Dugard (2016) also calls for further qualitative research on the concerns and experiences of households receiving basic water and those without access to piped water. Equally, Peloso and Morinville (2014:135) claim that "there is a disjuncture between realities of heterogenous water access and urban planning design that hinge on tap water infrastructure" which needs to be explored.

In studying water services in urban areas, contemporary scholars have mainly focused on water urbanisation and the hydrosocial cycles (Bakker, 2003; Swyngedouw, 2005; Budds, Linton and Mcdonnell, 2014; Boelens et al., 2016). The hydrosocial cycle notion has moved away from considering water and water processes as apolitical and asocial by unpacking the political, social and economic channels through which water is circulated in the city and the power flows in water distribution (Budds et al., 2014). This perspective is instrumental in showing the social ecological processes that shape urbanisation processes. While this approach is significant in demonstrating how power influences the production and distribution of water, it pays inadequate attention to everyday practices and "microspheres of negotiations" generated by infrastructure as well as how the practices generate and (re)configure the material infrastructure (Gandy, 2008:125).

Table 1.1. Towards articulating the knowledge gap based on the empirical context and the theoretical understanding

Empirical Context	**Theoretical understanding**	**The knowledge gap**	**Key elements/aspects of original contribution**
1. Inadequate access to water services and a state of hopelessness in the residents.	**Simone (2004) in Johannesburg, South Africa.** -The role of people-as-infrastructure where there is inadequate access to services. -Informal networks can provisionally close infrastructural gaps. **Anand (2017) in Mumbai India** -Water services provision is through relations between human and non-human infrastructure. **McFarlane (2011) in Sao Paolo, Brazil and Mumbai, India.** -Assemblage as a way to understand the complex relationships between the city as an everyday dwelling.	-The manifestations of informal and social networks in the provision of water services in informal settlements. -The interactions between the different elements of the infrastructure assemblage in the provision of water services.	Conditions and challenges of access to water services make normative modes of water governance malleable especially at the point-of-access. -The circle of water approach of *access-use-disposal* and its broader understanding of governance of water services.
2. Inadequate access to water services and a state of hopelessness in the residents.	**Bjorkman (2015) in Mumbai, India** -Water flow and access as contingent on an assemblage of physical, power and fragmented knowledge/rumors infrastructure.	-Who possesses the infrastructural knowledge? Is infrastructural knowledge gendered?	-Men-as-infrastructure. -Gradual changes to infrastructure produce transformative reconfiguration that leads to emergence of non-normatives modes of governance.
3. Leaking plastic water pipes running through the settlement.	**Heidegger (1962)** -The invisibility of infrastructure until there is a breakdown.	-What factors contribute to the visibility of infrastructure in informal settlements?	-People-as-infrastructure enhance the visibility of hydraulic infrastructure in informal settlements.

			-Material hydraulic infrastructure is highly visible in informal settlements.
4. Continued provision of water services by cartels.	**Ngunyi and Katumanga (2014) in Nairobi, Kenya** -State absence and state abstinence in service provision in low income areas. **Razon (2017) in Southern Israel** -Invisibility justifies neglect and inequalities in service provision.	-Why does the state render certain practices and situations invisible?	-Politics of invisibility as a manifestation of power relations between actors. -Politics of invisibility generates non-norative modes of water governance.
5. People queuing in line to procure water.	**Velzeboer et al. (2018) in Lilongwe, Malawi.** -The human body as infrastructure in last mile delivery.	-Is it the female or male human body that predominantly forms the hydraulic infrastructure?	-Women-as-infrastructure -The female-black-body as infrastructure in the South African context.
6. Persistent protests	**Bayat (2010) Middle East** -Quiet encroachment. Protests as a way of get the attention of the state.	-Why is service provision still inadequate despite the continued protests?	-Protests enhance the visibility of people-as-infrastructure.

In his seminal work, Being and Time, Heidegger (1962) claims that physical infrastructure is only visible when it breaks down. This idea has been contested in several studies such as Anand (2017) who argue that infrastructural breakdown brings to the fore the precarious nature of infrastructure as well as the fragile social agreements around it. He further contends that post-colonial states are characterised by hyper-visible infrastructure which shapes social and political processes of accessing resources and basic services (ibid). Therefore, although infrastructure in the global South is characterized by ubiquity and visibility, the link between the visibility and functionality of infrastructure cannot be explained by its breakdown only (ibid.).

Revealing the factors that contribute to the visibility of infrastructure could give a more nuanced understanding of the social relations around infrastructure. Exploring the concept of visibility as used by residents and the state to serve their different purposes/interests could provide a more complex understanding of governance practices. For example, Razon's (2017) study of Southern Israel found that the state employed invisibility to justify neglect and inequalities in services provision to the marginalized Bedouin citizens. Bayat (2010) study of the Middle East found that residents used invisibility through quiet encroachment which he defines as "silent, protracted, but pervasive advancement of the ordinary people on the propertied, powerful, or the public, in order to survive and improve their lives" (ibid: 46).

In a study of informal economies in the inner city of post-apartheid Johannesburg, South Africa, Simone (2004) found a confluence of fluid and provisional infrastructure and practices employed by people at the margins to navigate the city and thus referred to the confluence as conjunctions of people-as-infrastructure. However, Simone's notion of people-as-infrastructure does not depict how the different intersections such as gender, race and migrant status manifest in organizing the city. Similarly, Bjorkman (2015) study of water services in Mumbai, India, found an assemblage of physical, power and fragmented knowledge infrastructure which inhered with various actors. As with Simone's notion of people-as-infrastructure, the study did not investigate the intersections of knowledge-as-infrastructure. Yet, exploring intersectionalities in these notions could reveal power relations and social inequalities between actors, their interactions and governance practices (Collins, 2016).

Studies that have focused on the governance of water services in Africa include Peloso and Morinville (2013) who demonstrate how such everyday practices in Accra, Ghana, challenge the municipal water utility's capacity to provide water services thus forcing households to pursue different options to meet their daily

water requirements. In their study of water services in low-income areas in Lilongwe, Malawi, Velzeboer et al. (2017) found that human bodies formed a critical element of the hydraulic infrastructure. However, the study did not examine if it was the male or the female body that predominantly formed the infrastructure. Similarly, in a comparative study in Mukuru, Nairobi, focusing on the everyday interfaces of state and non-state actors in provision of water, sanitation and electricity services, Sverdlik's (2017) found variations in the interfaces of actors differentiated along the frequency of interactions, the level of bribery and probability for conflict. This comparative study examines the governance of water services through an infrastructure lens in Mukuru, Nairobi and Kya Sands, Johannesburg, South Africa.

1.6 PROBLEM STATEMENT

Water governance influences the extent of water access at various levels of society and therefore governance should form a key component towards addressing backlogs and challenges to water access (Tropp, 2006). Franks and Cleaver (2007) contend that deliberate and unintentional water governance systems are created through informal processes and practices of daily life of households. The normative governance structures may evolve owing to the agents' daily practices that shape water access through different norms and concerns (ibid.). Thus, water governance comprises both formal practices and everyday practices where the normative practices are conveyed through state management processes while everyday practices are less visible and defined, while nonetheless impacting on water access, use and disposal by the poor (ibid.). Zwarteveen et al. (2017:6) contend that "powers of control are the product of complex negotiations that only partly occur in formally designated water governance domains" because the deliberate and emergent practices (re)constitute and (re)create structures. A study of water governance based on a better understanding of the formal processes in interaction with everyday practices provides useful empirical underpinnings for more responsive policy making (ibid.). This study explored how infrastructure can foreground the complexities emerging from the diverse interactions which underpin urban water governance as an outcome of various practices among the key actors.

A focus on the practices of water services access, use and disposal gives a better understanding of the agentic nature of infrastructure, the relationship between infrastructure and practices as well as their co-constitution and mutual shaping of each other. Although infrastructure may be invisible in the formal realm of water provision, it is operated through various (in)visible practices and arrangements which mediate resource flows as well as power and social relations (Shove and Trentmann, 2018). Further, given that infrastructure

is continually appropriated to access resources, the analysis of practices, actors, processes and contestations at the urban margins can show new patterns which could inform a better understanding of governance (Coutard and Rutherford, 2015). Whereas the connective dimension of infrastructure is evident through bridging people in different spaces and times, it also disconnects others in the same space to produce inequalities in access to resources and services.

A good starting point in examining governance of water services, would be through exploring 'who' and 'what' is included in various infrastructure arrangements, mainly because the approach uncovers the levels of agency possessed by the different actors. Using an infrastructure lens enables the agency of both the infrastructure and the various actors (as well as intersections such as gender, race, age) to be investigated. Further, the differentiated configurations of urban infrastructure facilitate situated analysis and understandings which in turn enables theoretical generalization about infrastructure.

In order to adequately address water access challenges, there is a critical need for a more nuanced understanding of the reality on the ground. The urban water governance lens investigates the status quo of conditions and challenges of water services, actors and their practices as well as the processes of negotiation for gaining and maintaining access so as to point to possible alternatives for urban water access (McFarlane and Silver, 2017). This entails asking questions such as: How do residents of informal settlements meet their daily water requirements? What are the lived materialities and realities of residents of informal settlements in accessing, using and disposing of wastewater? What are the interactions of actors in gaining and maintaining water access, use and disposal? Guided by the research question presented in the next sub-section, the study endeavoured to fill the knowledge gaps identified above based on the following research question and a comparative study of two informal settlements, one in Nairobi, Kenya, and the other one in Johannesburg, South Africa. Figure 1.1 presents the generalized mapping of the key elements of the motivation of the study.

1.6.1 Research Question

Arising from the context and motivation presented in the previous sections, the study was guided by the following research question:

What are the modes of water governance in urban informal settlements in Kenya and South Africa ?

With specific reference to the case studies of Mukuru in Nairobi, Kenya, and Kya Sands in Johannesburg, South Africa, the sub-questions of the study were conceptualised as follows:

1. What are the conditions and key challenges of water access, use and disposal in informal settlements?
2. Who are the key actors and their roles in water services in informal settlements?
3. How do people in informal settlements negotiate and secure water access? What are the inter and intra-household dynamics regarding water access in informal settlements?

1.6.2 Working Hypothesis

Based on the preliminary understanding surrounding the study the working hypothesis was conceptualized as follows:

Based on the preliminary understanding surrounding the study, the working hypothesis was conceptualized as follows: The modes of water services governance emerge from the diverse responses of actors in their roles and practices versus the conditions and challenges in gaining and maintaining water access. The conditions and challenges of access to water services in informal settlements render the normative mode of water governance highly malleable at the point of access and induce non-normative governance modes characterized by perpetual suspension-of-rules which create the critical fluidity and space for (re)negotiated access. Similarly, the agency of material infrastructure is enhanced beyond what would normally be envisaged under normative mode of governance while human bodies become deeply enmeshed into the material infrastructure at the point of water access. Access to water services is therefore sustained through an assemblage of infrastructure comprising material, people and knowledge elements with invented coproduction as a key component of the process.

1.6.3 Delimiting the scope of the study

This study investigated the formal and informal elements of the governance of water services through elements of infrastructure. Thus, the study is intended to be situated within the focus areas such as non-

normative governance, infrastructure and social relations, and thus only partially links to some fields such as normative governance, neoliberalism and commodification.

Whereas as an area of study informal settlements is a huge field with enormous theoretical underpinnings, this study limits itself to two spatially bounded settlements which are characterised by different demographic and social-economic/political underpinnings. However, since informal settlements do not happen in a 'vacuum' (they are actually categorized as so on the basis of being deemed to share multiple attributes irrespective of their diverse unique attributes on a case-by-case basis), the findings from these case studies could be relevant to other informal settlements with similar peculiarities and might therefore be useful in re-conceptualising the governance of water services. However, even though sources covering other case studies have been reviewed and cited in the study, the comparison of the findings from these case studies with experiences in other informal settlements in both or other countries, does not constitute part of this study.

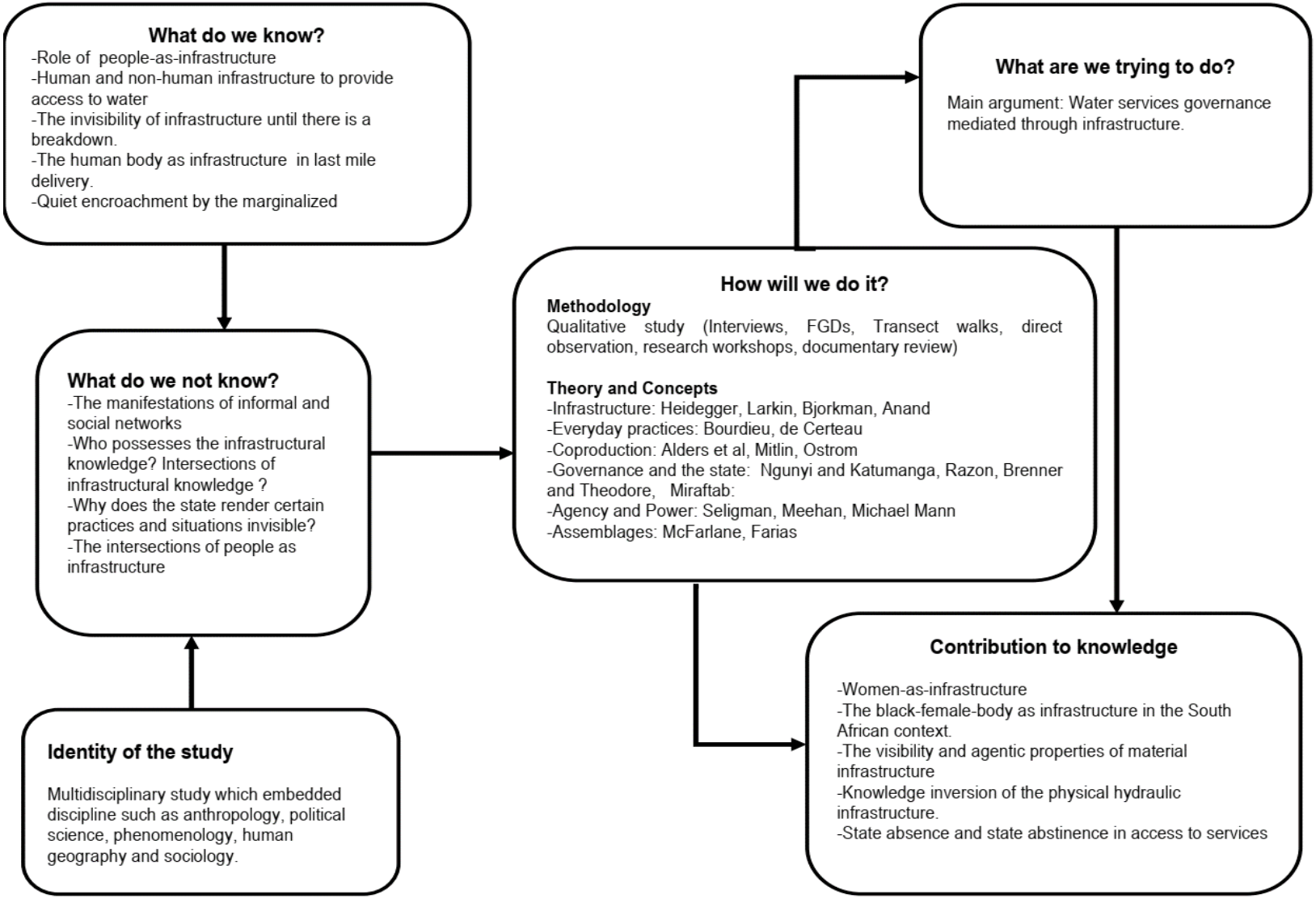

Figure 1.1: Overall mapping of the study (Author, 2021)

1.7 THE RESEARCH STRATEGY: LINEAR OR ITERATIVE?

Given the complexity of the research objectives, the overall research strategy was iterative and non-linear. This entailed a back and forth process that involved going over literature review, data collection, data analysis as well as fine-tuning the research questions repeatedly. Moreover, the methodology and the theoretical/conceptual framework were iteratively refined throughout the entire research process. The research strategy is represented diagrammatically in Figure 1.2.

In a nutshell, Stage 1 aimed at generating a research proposal and involved appraisal of background studies on water governance in order to formulate the initial research question and study objectives. This stage also entailed the selection of the two case studies that formed the basis of the comparative study. At the end of this stage the research proposal was submitted for examination and later defended before a panel. Stage 2 involved the second iteration of the research proposal as well as the application for ethics clearance. Research instruments were prepared based on ongoing literature review and physical/reconnaissance visits to the two case study sites. Primary data collection was carried out from August 2018 to June 2019. Data analyses were done concurrently with data collection as well as after the data collection activities. Preliminary analyses during data collection stage was conducted so as to establish if there were missing data and to identify any gaps that needed to be filled through subsequent data collection processes.

As the field work progressed, I began to sense that the data collection phase was suggesting the need for a new lens to interpret the data which gave the literature review process a reflective dimension as opposed to a merely propositional appraisal exercise. The initial supposition before the preliminary field work was the salient influence of material infrastructure in access to water services but gradually the mediating role of infrastructure was extended to include both the human and non-human elements of infrastructure.

Likewise, the findings reinforced my initial proposition of adopting a theoretical bricolage approach to anchor the study. The approach comprised of theoretical principles distilled from diverse multiple disciplines to the research problem given its complexity. The responses from the interviews and observations of the practices on the ground as well as the patterns that emerged from the initial data analyses in the field contributed to a radical change in the choice of previous studies and related approaches to their appraisal.

Stage 3 entailed further data analyses, synthesis of findings and writing up of the study. Moreover, the research question and objectives were revisited at this stage in order to assess if they were adequately addressed and the extent to which the initially identified knowledge gaps had been filled. In all stages, working papers were generated some of which were presented in international conferences as indicated in the declaration section of this thesis (see page ii).

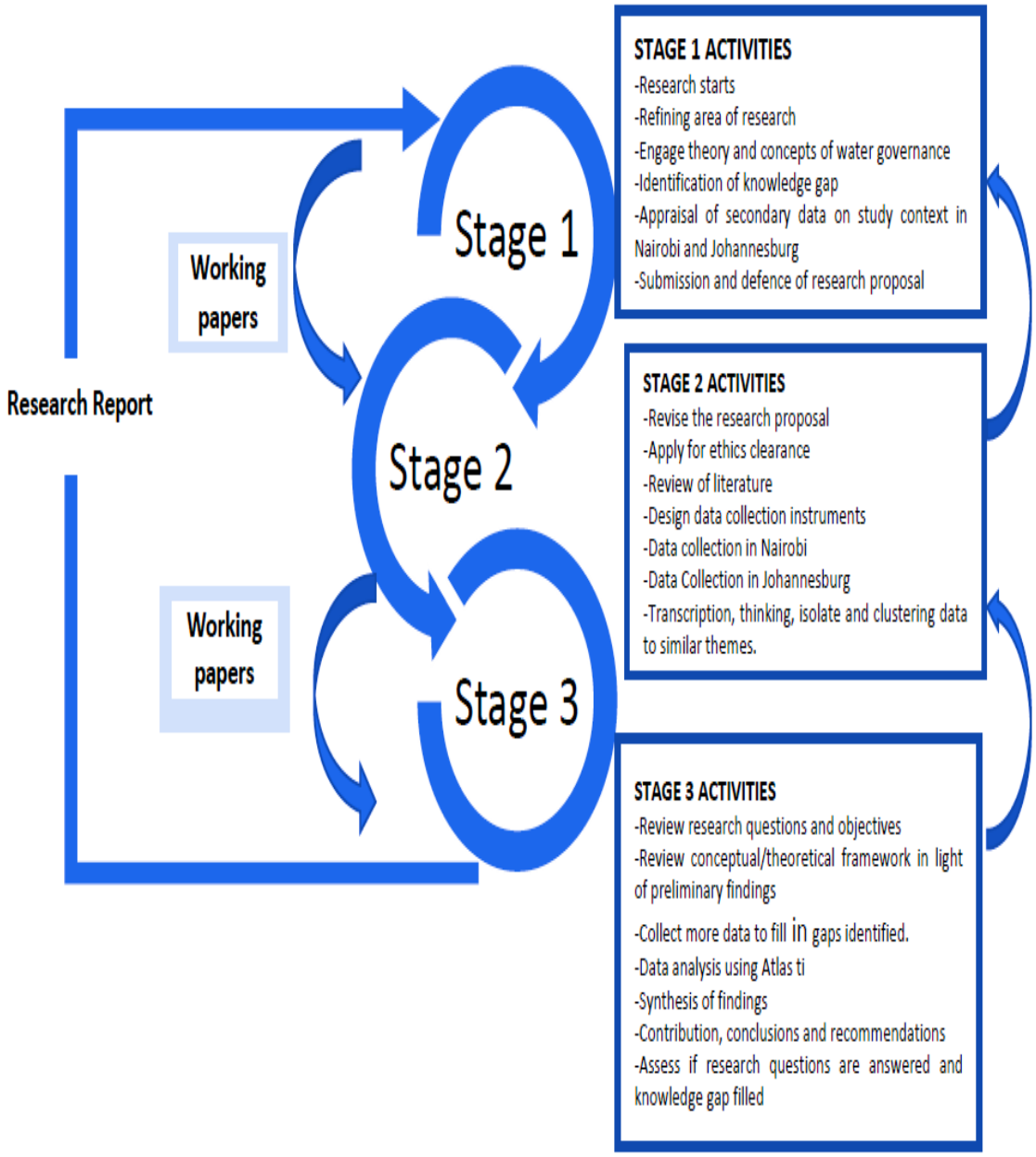

Figure 1.2: The iterative research strategy employed in the study (Author, 2020)

The study employed a comparative and qualitative methodology which involved situating the research within the setting where participants have real time experience of the issue being investigated (Creswell, 2007). A multi-method data collection approach was used in order to triangulate the data gathered from both research contexts. The study relied on direct observation mainly based on transect walks, documentary analysis, in-depth interviews with key informants, residents and water vendors, as well as focus group discussions (FGDs). Thematic data analyses were executed through a dual system that interlinked automated data analysis using *Atlas ti* (a qualitative data computer aided software) and manual data coding based on matrices. The comprehensive research methods utilized for the study are elaborated in Chapter 3.

1.8 THE STRUCTURE OF THE THESIS

This section presents an outline of the nine interlinked chapters of this thesis as guided by the overarching research question and the sub-questions.

The first chapter presents the background of the study, the statement of the research problem, the research question, objectives, a working hypothesis and the research strategy. Chapter 2 presents the literature appraisal and theoretical underpinnings of the study. It appraises the literature on core relevant theories and concepts in order to adequately guide data collection and analysis towards the resolution of the sub-questions and the overall research question. The chapter reviews relevant studies based on the main themes of governance, infrastructure, actors and power, coproduction and assemblages. It therefore anchors the empirical research and discussions of the findings from the case studies. From the literature review, the research gaps addressed by the study were generated as well as a conceptual framework of water governance to guide the rest of the study.

Chapter 3 presents the research design and methodology. A justification of the case study design is presented as well as a brief introduction of the two case study areas. The chapter then presents the data collection methods and tools followed by a presentation of the various anticipated and emergent ethical challenges faced during the fieldwork and in the course of the research. In response to sub-question 1, Chapter 4 presents the conditions and challenges of water services in Mukuru. As a basis of providing an extensive background to the provision of water services for the settlement, the chapter examines the physical, socioeconomic and legislative profiles as well as the legal and institutional frameworks governing the settlement. This chapter forms the background for subsequent data presentation and analyses in Chapter 5.

Chapter 5 addresses the second and third sub-questions on the state and non-state actors in the case of Mukuru. The chapter further elucidates the practices of the different actors in gaining, maintenance and denial of access to water services. The chapter shows how the complexity and intensity of the water services problem leads the state opting not to "see" it. The chapter goes on to reveal the challenges encountered by the state in trying to regain control over the distribution of water services after takeover by elite groups.

Chapter 6 deals with the first sub-question on the conditions and challenges of water services provision in Kya Sands. The chapter foregrounds the mutual interdependence between the provision of basic services in the settlement. Besides, the chapter also demonstrates the crucial role of social relations in access to water services. Chapter 7 presents discussions on the second and third sub-questions on the actors and their practices in water services in Kya Sands. Equally, the chapter shows the power struggles among different actors and the strategies they employ at different times and spaces in pursuit of their water-related interests. The chapter demonstrates that state actors possessed static knowledge of the water reticulation while the residents possessed intelligence of the water reticulation which remained dynamic and fluid.

Chapter 8 presents a cross-case analysis of the sub-findings emerging from both case studies as consolidated in the substantive chapters and engaging them 'in conversation' with theory and the conceptual framework adopted for the study in order to address the sub-questions and the overarching research question. Chapter 9 draws a synthesis of the resolution of the overall research finding through a weaving of the sub-findings towards an overall consolidation of findings and conclusions on the research question based on the theoretical reflections the sub-findings from the case study. In addition to substantiating the findings, the chapter further links the salient issues with the literature and the conceptual framework presented in Chapter 2. The original knowledge contribution of the study, the limitations of the study and recommendations for future research are then articulated and presented. The final part of the study constitutes the additional but relevant information in the form of appendices which provide a more enriched perspective of the research.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 INTRODUCTION - AN OVERVIEW OF THE THEORETICAL FIELDS

This chapter presents literature appraisal of theories, concepts and empirical studies which anchored the research. The chapter therefore crystallizes the key ideas and concepts relevant to the study as shown in Figure 2.1. These include infrastructure, governance, actors, power, agency, coproduction and everyday practices. These concepts together create the foundation for the "theoretical bricolage" used to investigate water governance in informal settlements of cities of the South (Kincheloe, 2001:335). Theoretical bricolage entails moving beyond and across different disciplines in the research process, knowledge production and interpretation as well as actively constructing research approaches based on multiple lenses to study a research problem. Furthermore, the application of bricolage entails recognizing that a multilateral view of the subject under study is likely to lead to a deeper inquiry of reality or phenomenon under investigation as a result of the multiple perspectives of the analyses (ibid.). Moreover, employing a single lens to a research problem such as the one identified for this study ignores the dynamics of power inherent in hybrid and negotiated forms of governance. The guiding approach emanated from the challenges and opportunities encountered in addressing the research question from a single discipline. Theoretical bricolage of various social theories and philosophies was applied in order to adequately situate the study as well as to guide the articulation of the theoretical framework.

In addition, a bricolage approach was expected to enable greater theoretical coherence given that a single approach would be inadequate to fulfill the requirements of the complex research objectives. Likewise, the increased quest for relevant and coherent policies calls for the integration of diverse disciplines so as to address the matter in question (Kincheloe, 2001). The complexity and fluidity of everyday life makes it imperative to understand the daily lived experiences as well as their processes and changes thus enabling a more enhanced understanding of phenomena such as the highly dynamic water access scenarios in informal settlements. The study utilized theoretical insights from disciplines as such anthropology, political science human geography and sociology to facilitate better engagement with the complex reality under investigation. Studies such as Cleaver (2002); Cleaver and Koning (2015); Achwoka (2016) utilized this approach to analyze water governance by using concepts from diverse disciplines in order to gain a better understanding of governance processes.

The chapter presents the theoretical underpinnings of the study as guided by the theory of infrastructure and its relevance to analyzing the status quo of water services in the informal settlements. This include the concept of water governance, actors in water services, the state and its practices, individual and collective agency and everyday practices. I consulted and appraised a broad range of studies and later on prioritized which among them was most relevant for my study. Table 2.1 presents the schedule of appraised sources according to key knowledge/theoretical-themes and the layers of readings either as core, secondary or tertiary pertinent for the study. As elaborated in detail in Chapter 9, the core readings also constitute the primary references from which original contribution of the study was envisaged, pursued and assessed at the end of the study while the secondary and tertiary readings provide literature on the narrower categories such as specific sub-fields of the research.

2.2 THEORY OF INFRASTRUCTURE

In the recent past, academic debates in anthropology and urban studies around the concept of infrastructure and its impact on everyday life have become salient (Bjorkman, 2014; McFarlane and Graham, 2015; Anand, 2017,). The tension between the constitutive dimension (material form) and the connective dimension (how infrastructure structures relations) and the different meanings and interpretations that infrastructural dimensions evoke for different people is useful in examining everyday life around various infrastructure (Anand, 2017). In order to access resources, actors rework and adapt material structures thereby making infrastructure "a relational space of investigation" that examines the dynamic relations around and produced by the infrastructure (Venkatesan et al., 2018:2). Given that material forms are unequally distributed, people and things interact in disparate ways that produce diverse and uncertain political outcomes which constitute the modes of governance.

Adopting an infrastructure lens in this study enabled me to investigate how infrastructure configures and is in turn configured by the urban informal settlement space and its role in shaping urban spaces as arenas of "commonality, interaction and conflict" (McFarlane, 2011:217). Given that people often negotiate through the visible and hidden elements of infrastructure, both the technical and symbolic orientations can be analyzed to reveal the social relations and the microspheres of negotiation for water access (Anand, 2012). Additionally, the concept is also relevant in demonstrating how people appropriate infrastructure both to cope with water scarcity as well as for economic gains. Likewise, ".. infrastructures are very good to think with. They are materially, socially, and symbolically dense; (…) often banal, (…) taken for granted; yet they are

Table 2.1 : Layers of pertinent theoretical sources

KEY THEORETICAL/KNOWLEDGE THEME	CORE SOURCES (INTERNATIONAL, GLOBAL, SOUTH, LOCAL)	SECONDARY SOURCES	TERTIARY SOURCES
Infrastructure	Heidegger (1962) 'Being and time' **Review** Simone (2004) 'People-as- infrastructure'**(South Africa)** Bjorkman (2015) 'Pipe Politics, Contested Waters' **(India)**	Harries (2014) (**South Africa, Ghana)** Bowker et al.(2010) **Review** Venkatesan et al. (2018) **Review** Larkin (2013) **Review**	von Schnitzler (2008) **(South Africa)** Bear et al. (2014) **Review**
Assemblages	McFarlane (2009, 2011) Cities as assemblages **(Brazil and India)**	Farias (2010) **Review** Farias, I. and Bender T. (2011) **Review**	Koster (2019) **Brazil**
Governance and the role of the state	Pierre and Peters (2005) Governing Complex Societies: Trajectories and Scenarios **Review** Ngunyi and Katumanga (2014) From Monopoly to Oligopoly of Violence: Exploration of a Four-point Hypothesis Regarding Organised and Organic Militia in Kenya **(Kenya)** Brenner and Theodore (2002): On neoliberalism **Review** Miraftab (2004) Making Neo-liberal Governance: The Disempowering Work of Empowerment **(South Africa)** Razon (2017)). Seeing and Unseeing Like a State **(Israel)** Roy (2009) Why India cannot plan its cities **(India)**	Budds and Mc Ghanahan (2003) **(Global South)** Bakker and Morinville (2013) **Review**	Fukuyama (2013) **Review** Kuchinskaya (2014) **Belarus**

Actors, power and agency	Mann(2008): Infrastructural power revisited **Review** Wafer (2011): Informality, Infrastructure and the State in post-apartheid Johannesburg (**South Africa)** Bayat (2000, 2010): Life as Politics. How Ordinary People Change the Middle East **(Middle East)** Chatterjee (2004) The Politics of the Governed—Reflections on Popular Politics in Most of the World **(India)**	Bjorkman (2015) **India** Sverdlik (2017) **Kenya**	Hufty (2011) **Review** Ballard (2015) **(South Africa)**
Social relations	Bourdieu (1977) Outline of a Theory of Practice **Review** Bourdieu (1984) Distinction: A Social Critique of the Judgement of Taste **Review** Bourdieu (1990) The logic of practice **Review** Bourdieu and Wacquant (1992) An Invitation to Reflexive Sociology **Review**	**Katsaura (2013) (South Africa)** Benit-Gbaffou and Katsaura (2014) **(South Africa)**	Zimmer and Sakdapolrak (2012) **(India)** Zug (2014) **South Sudan** Giddens (1984) **Review**
Coproduction	Ostrom (1996) Crossing the great divide: coproduction, synergy and development **(Brazil and Nigeria)** Mitlin (2008) With and beyond the state — co-production as a route to political influence, power and transformation for grassroots organizations. **(Global South)** Cornwall (2000 and 2002) Making spaces, changing places: situating participation in development'	Joshi and Moore (2004) **Ghana and Pakistan** Watson (2014) **South Africa** Mitlin and Bartlett (2018) **Global South** Makau and Lines (2018) **Kenya** Mintzberg and Waters (1985) **Review**	Olumuyiwa (2016) **South Africa**

the bearers of (……) an easier life, safety, security (Watts, 2018 as cited in Anand et al., 2018: unpaginated). Hence, thinking with and through an infrastructure lens is useful in exploring the conditions and challenges of water services in informal settlements.

For purposes of this study, infrastructure has been conceptualised as an assemblage of material forms (water distribution systems), people (human body and social relations) and knowledge which are diagrammatically represented in Figure 2.1 (see Section 2.3 for review on assemblages. The rest of this section further elaborates the three components of infrastructure (material, people and knowledge). The section begins with a review of sources on material infrastructure as commonly understood and its relationships with the other two dimensions of infrastructure.

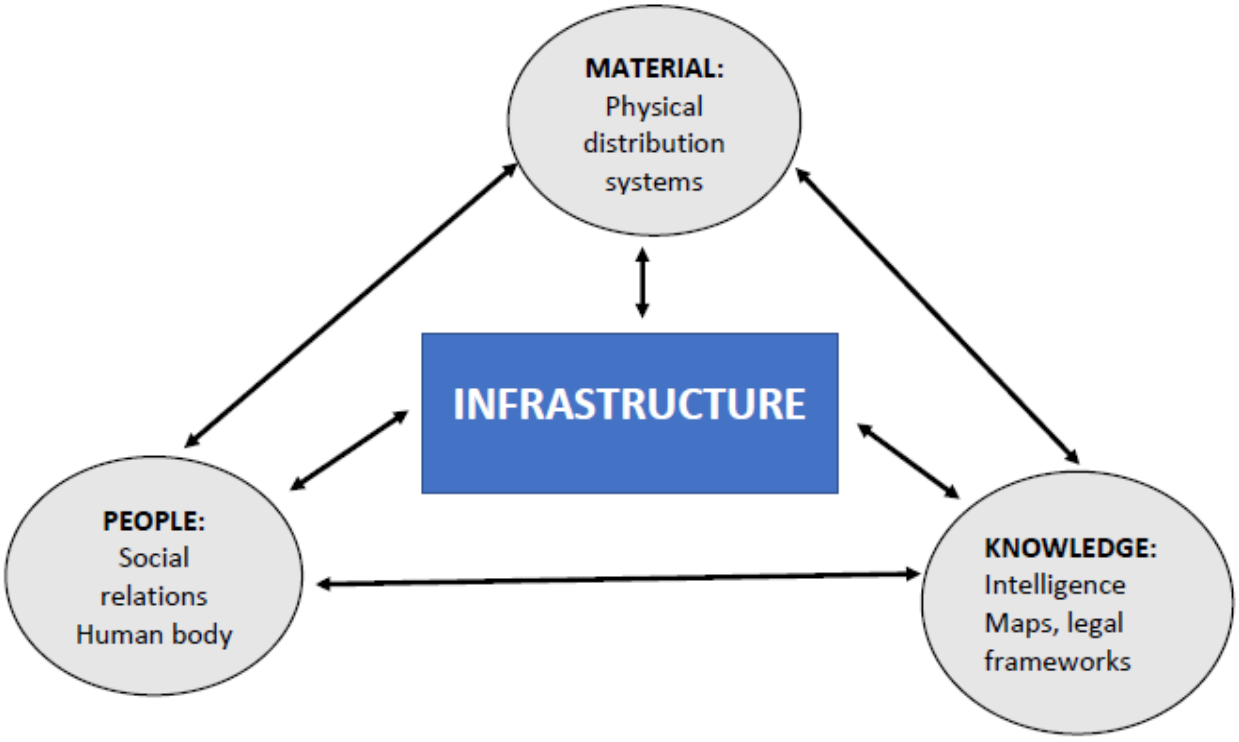

Figure 2.1: The assemblage of infrastructure (Source: Author, 2019)

2.2.1 Infrastructure as Material

The material forms of infrastructure mainly consist of the physical substances such as pipes, pumps and taps through which water passes while dictating the type of networks, the flow rate and the destination of the water (Heidegger, 1962 and Larkin, 2013). In his seminal work, *Being and Time*, Heidegger (1962) provides an

ontological foundation for the being of things which serves as a point of departure for the discourse on infrastructure as applied in this study. He examined the various modes of existence of objects and the way people encounter objects both from a theoretical perspective and in their everyday experiences (ibid). The two concepts of his philosophical thinking that prove to be particularly relevant for this study are *Dasein* and equipment (things) as they facilitated deeper understanding of the phenomena under investigation. Heidegger's core argument is that our understanding of and the meanings attached to the being of things provides us a particular way of relating to things (ibid). He argues that in order to understand the "being" of the object under study, it is important to know the entity through which being is to be captured (ibid). In other words, who is knowing the object? He introduces the notion of *Dasein* to denote the "way of being of humans" which essentially shapes how they perceive things (ibid). The distinction between *Dasein* and other entities is important because human beings have agency and can choose how or who to be through their everyday activities and through inferred meaning(s) to such activities (ibid.). This understanding of *Dasein* was applied in this study to facilitate the investigation of the everyday modes of engagement between people as well as the way people attribute meanings to their everyday experiences.

Visibility of infrastructure

Heidegger (1962) further elaborates the three modes of encounter between people and equipment as they perform the tasks at hand and how these encounters produce (in)visibility of the equipment. Firstly, the *readiness-to-hand* mode occurs when a person focuses on the *task-at-hand* and is not conscious of the equipment being employed because it is functioning properly. Thus, the person has minimal conscious awareness of the equipment in use it thus moves to the background (subconscious) (ibid). Since the equipment functions as it should, and the user does not pay attention to it, it appears to be "invisible" to the conscious mind. Secondly, the present-at-hand mode occurs when the experience with the equipment is no longer the point of attention but the equipment itself becomes an independent object that takes away the attention of the subject for instance when an equipment breaks down while in use (ibid). Present-at-hand makes the everyday experiencing-user of the equipment to pay attention to the object making it "visible". Finally, the unreadiness at hand takes place when the activity is interrupted by the breakdown of the equipment and therefore the task cannot be accomplished. He points out that the being of equipment is a totality which allows it to do what it is meant to do (ibid).

Heidegger (1962) moves on to discuss the disruptions of the readiness-to-hand encounter through which the ready-at-hand equipment becomes visible and interferes with performance of the task. The equipment becomes present-at-hand thus interfering with and reconstructing the everyday experiences and practices. Examining disruptions reveals how infrastructural breakdowns impact on everyday life as well as how these breakdowns shift focus to the infrastructure itself at the cost of target-task (Baumgardt, 2017). In discussing the visibility of infrastructure, Heidegger (1962:102) points out that the disruptions "permit the entities with which we concern ourselves to be encountered in such a way that the worldly character of what is within the world comes to the fore". Heidegger's argument that infrastructure is generally invisible but becomes visible when disruptions occur is crucial for this study in exploring the conditions of the hydraulic infrastructure in both study contexts. There are three types of disruptions that make infrastructure "visible" namely conspicuousness, obtrusiveness and obstinacy (ibid.). Conspicuousness is a disruption that occurs when equipment does not serve the purpose for which it was intended because it is deficient or defective (ibid; Harries, 2014). Obtrusiveness takes place when the equipment needed to perform a task is not-at-hand and therefore is not available to be used. Finally, obstinacy arises where equipment is neither missing nor unusable but simply "stand in the way of our concern" thereby drawing our attention to it and yet we have no time to focus on them (Heidegger, 1962:103).

Heidegger's (1971) work on 'Building dwelling thinking' conceptualizes the idea of dwelling as a place where things or material objects gather and is actualized through the everyday practices in the inhabited space (ibid). He states that, "spaces through which we go daily are provided for by locations; their nature is grounded in things, (…) relations between locations and spaces, (…) help us in thinking of the relationship between man and space (ibid:6). Thus, dwelling has a connective property and discourses on dwelling necessarily involves relations that connect spaces. Heidegger further argues that dwelling "accomplishes its nature in the raising of locations by the joining of their spaces" (ibid.:8). This understanding of dwelling can reveal the interactions between people and equipment in the assemblage where the agency of the individual material parts and the collective change both temporally and spatially. Given that dwelling extends beyond technical dimensions to include relations around an object connecting spaces through an assembly, the concept of dwelling as is related to discussions on assemblages by McFarlane (2009, 2011) is presented in Section 2.3.

Investigating the visibility of infrastructure provides an understanding of how the "everyday infrastructural experience" generates different social relations and everyday experiences (Graham and McFarlane, 2015:1).

Heidegger's views on infrastructure enable the theorization of the pervasiveness and invisibility of infrastructure as well as the capacity of infrastructure to shape and change our perception of everyday life (Heidegger, 1962) Moreover, questions of visibility and invisibility are important manifestations of the workings of power and control over the infrastructure (ibid.). Likewise, Heidegger's notions of 'ready-to-hand' and 'present-at-hand' are useful in investigating invisible power dynamics in infrastructure breakdown (Jackson,2013; Appel et al., 2015). This study applied Heidegger's theory to examine how the visibility and invisibility of material infrastructure impact on the power relations among actors. Moreover, paying attention to infrastructure can aid the distinction between "enabling infrastructure and functioning infrastructure" (Eales, 2011:48). This differentiation is important because the presence of enabling infrastructure does not necessarily mean that it will be functional and perform the expected tasks due to disruptions that may occur. Thus, functioning infrastructure is ready-at-hand and can therefore be deemed to be "invisible".

Infrastructure and agency

The "infrastructural inversion" process moves infrastructure to the foreground from the position of "substrate to substance" toward an understanding of the processes, practices and actor-relations through and around infrastructure (Bowker et al., 2010:99). This implies examining the agentic attributes of infrastructure by viewing infrastructure as something that is acted upon and something that acts upon other things. Inverting infrastructure is fundamentally a relational concept that focuses on the dynamics of the infrastructural relations connected to activities and structures which interact to produce an effective system of resource access. Hence, infrastructure creates and augments the agency of different actors and relations between them (Venkatesan et al., 2018). Equally, the individual and collective agency of actors and their interactions are dynamic thereby generating uncertainty and contestations which lead to different modes of governance in different spaces and time (Bear et al., 2014). For instance, increased agency generated by hydraulic infrastructure enables utility companies and local leaders to reach people through real or perceived infrastructural networks (Venkatesan et al., 2018). Besides, Larkin (2013:329) argues that infrastructure "are things and also the relations between things" such that both perspectives can be analyzed to examine how material aspects structure and alter social interactions to create new forms of governance.

Several studies have applied this concept of material infrastructure in the study of water governance in various contexts. Bjorkman (2014) study utilized an infrastructure lens to analyze the fields of contestation and negotiations that material hydraulic infrastructure triggers and found that access to water services in

Mumbai was dependent on diffuse and intricate assemblages of information, power and material forms which influenced the flow of water in the city. Von Schnitzler (2008) study applied the concept of material infrastructure (specifically the water meter), to analyze the impact of its introduction on everyday life of the residents of Soweto township in South Africa. The study found that the water meter did not just regulate water consumption but also produced a new typology of citizenship whereby the meter became a symbol of state power and an arena of political negotiation between the state and residents. The study revealed how the practices of the state with regard to the water meter engendered a moral citizen who endeavored to conserve water because of the restrictions that were imposed (ibid.). The current study took a broader view of infrastructure to include both material and non-material dimensions and how they interact relationally.

2.2.2 People as infrastructure

Given that informal settlements are typified by limited formal piping (whereby water provision is a combination of formal and informal infrastructure from the source to home) the human body and social relations form a critical part of the infrastructure for water access. In his work on "*people as infrastructure*" based on the case study of Johannesburg, South Africa, Simone (2004) refers to the provisional, fluid and diverse character of urban areas where people navigate the city and access basic services through conjunction. The term entails the process of building infrastructure by engaging "complex combinations of objects, spaces, persons, and practices. These conjunctions become an infrastructure – a platform providing for and reproducing life in the city" (ibid.:408). Simone's idea of conjunction as related to McFarlane (2009, 2011) notion of assemblages is presented in Section 2.3. Although infrastructure can deepen our understanding of the material forms and the political relations that they are embedded in, "the distinction between infrastructure and sociality is fluid and pragmatic rather than definitive" (Simone, 2015:33). Building on his earlier work, Simone expresses the idea of people-as-infrastructure in relation to urban space stating that the notion of 'people-as-infrastructure' is, "a fabric of entangled attunements, maneuvers, and antagonisms among shape-shifting constellations of materials and bodies" (Simone, 2021:1). He further explains that the idea denotes the dynamic and messy character of social relations and processes since new relations are continuously recreated so as to navigate urban life (ibid).

Since infrastructure is splintered and disjointed, knowledge, which normally inheres in diverse people, becomes necessary towards making sense of it and to make it functional. Equally, Simone argues that a distinction between infrastructure and people is difficult because "people work on things to work on each

other, as these things work on them" (Simone, 2014:33). He further points out that infrastructure "attracts people, draws them in, coalesces and expends their capacities" (ibid.). Thus, people-as-infrastructure is a crucial space for (re)production of social and political systems.

The notion of *"people-as-infrastructure"* is particularly compelling for this study for several reasons. Firstly, it brought to mind the fact that the concrete materiality of infrastructure and the human body form part of hydraulic infrastructure in instances where water is scarce or unavailable in people's houses (Wafer, 2011 and Velzeboer et al., 2017). This is especially the case in informal settlements where residents do not have piped water in their houses and therefore the human body becomes an important component of the water services infrastructure. However, as water is heavy, bulky and consumes time to transport, there is a limit to which the human body can function as a component of its infrastructure (Bjorkman, 2014). Peloso (2014) found that residents of Accra, Ghana used situated knowledge and their bodies to enhance access to water services so as to meet their daily water requirements. Equally, Mitlin and Bartlett (2018) argue that people are the infrastructure through which coproduction takes place since the relationships and structures needed for coproduction can only take place through and with people. Further details on coproduction are presented in Section 2.8. Secondly, people and their social relations form nodes comprised of everyday life and related practices. The relational dimensions of infrastructures comprise engagements and interactions that people employ to consolidate as well as to expand their access to water services (Wafer, 2011). Thirdly, an intersectional analysis in examining people as constituting hydraulic infrastructure can interrogate whose body forms part of the water provision infrastructure and the rationale for it. In other words, is it the male or female body that predominantly forms part of the water infrastructure?

Simone's notion of people-as-infrastructure overlooks the complex intersectional ways in which the practices around access to water services are embodied by factors such as race, gender, migrant-status, and ability. Given that access to water services is typified by power relations and inequalities a more nuanced understanding of the notion of people-as-infrastructure could be gained by considering the implications of various intersectionalities that go beyond the male-female binary. Intersectionalities can reveal how power relations are differentiated and the impact of various intersections on everyday life because, "intersecting systems of power catalyze social formations of complex social inequalities that are organized via unequal material realities and distinctive social experiences for people who live within them" (Collins, 2015:14). Thus multiple intersectionalities produce heterogeneous experiences in gaining and maintaining access to water

services for the residents. Besides, the notion of intersectionality is key to and understanding of the layers of complexity within the idea of people-as-infrastructure thus giving a nuanced understanding of the governance of water services in informal settlements.

Peloso's (2014) study in Ashaiman, Accra, found that faced with intermittent water flow from the piped system, residents in low-income areas created reliable supply using conjunctions of multiple infrastructures comprised of people and objects. These conjunctions depended on the creativity and innovation of residents in gathering knowledge about water availability and money needed to procure water which was particularly important for the urban poor who purchase water in small quantities. Based on a study on water services in Malawi, Velzeboer et al. (2017) found that, as the forms of hydraulic infrastructure in low-income areas were inadequate, human bodies of water vendors or householders brought water from the source to the house and thus supplemented the existing material infrastructure. However, their study did not investigate whose human body predominantly supplemented the hydraulic infrastructure.

2.2.3 Knowledge as Infrastructure

Knowledge infrastructure makes it possible for people to know when and where water is available and at what cost. Additionally, knowledge of and intelligence about the reticulation of infrastructure facilitates the repair of breakdowns, maintenance and expansion of the network. Based on an ethnographic study of water services in Mumbai, India, Bjorkman (2014:129) argues that "knowledge about things like pipe locations, pressure, timings and operations of valves- as well as the webs of power and influence that animate these volatile flows, appearances and disappearances of water" is an aggregate of information found in different places and with different people. Bjorkman further points out that the splintering of infrastructural knowledge sites has led to diffusion and diversification of spaces, knowledge generation and distribution as well as the quest for control of information resources. Thus, based on the information available one has to extrapolate assuming that the current trends will continue for the foreseeable future. Therefore, knowledge of infrastructure is a decisive, strategic yet elusive requirement for the provision of water services (Bjorkman, 2014).

Furthermore, exchange of information about the condition of the infrastructure becomes critical in hedging risks posed by the fragile infrastructure through an ongoing mobilization of water-related "rumor, stealth and speculation" (ibid.:130). Nevertheless, since infrastructural knowledge remains fragmented, dispersed and

personalized those who possess more of it become key actors in access to resources. According to Desai (2018) everyday infrastructural practices have led to a multiplicity of knowledge sites in Mumbai, India due to the piecemeal infrastructural violation which are not reflected in official records. Likewise, water in Mumbai is kept flowing by local staff, mainly plumbers and residents who have knowledge about the water piping and other infrastructural adjustments made over the years (Bjorkman, 2016). Equally, since the residents are 'closer to the ground', repairs are executed based on accumulated local knowledge which is often unwritten and decentralized leading to distributed expertise (Bjorkman and Harris, 2018). Infrastructure also includes the regulatory framework such as the laws and policies that guide state-decision making on the provision of water services.

Summary

This thesis argues that water governance is mediated by an assemblage of infrastructure which are produced by actors' practices while at the same time the practices of various actors produce the infrastructure. The idea of infrastructure which encapsulates both the material and non-material dimensions brings to the fore new forms of governance in the everyday context. Infrastructural breakdown therefore reveals the unseen power dynamics and processes since the visibility of infrastructure is a symbol of power especially in the context of repairs and maintenance. An infrastructure lens was useful in exploring governance practices of both state and non-state actors' because although the interest of this study is not in infrastructure per se, thinking around infrastructure can reveal the processes and practices of water governance (Collier, 2011; Anand, 2017). Given that infrastructure encompasses the general context in which water access is governed, the concept of infrastructure was therefore useful in analyzing water governance beyond the physical objects to include people (the human body and social relations) and knowledge. Cognizant of the fact that infrastructure is a broad concept, this study defines and delimits infrastructure to material forms, people (human body and social relations) and knowledge as shown in Figure 2.2. Further, the study reveals how infrastructure is complicated by intersections such as race, gender and migrant status. The next section appraises the theory of assemblages as it is applied in this study.

2.3 THEORY OF ASSEMBLAGES

The theory of assemblages was first articulated in the ground-breaking work*, A Thousand Plateaus,* by Deleuze and Guattari (1980). Although they do not explicitly refer to or define the theory of assemblage in their study, they presented it as "the general logic of assemblage" (Nail, 2017:21). In his later work, Deleuze

defined assemblage as `a multiplicity constituted by heterogeneous terms and which establishes liaisons, relations between them (Deleuze, 2007:52). Over time, researchers such as De Landa (2006) and McFarlane (2009, 2011,) have engaged the theory in investigating social relations. De Landa (2006) expanded Deleuzian concept of assemblage by providing a theoretical framework for analysing assemblages through three axes; material/expressive, territorializing/deterritorializing and genetic/linguistic resource.

McFarlane (2009, 2011) has extensively employed the concept of assemblage to explore the confluence of urban politics, inequalities and knowledge in the global South context. This study will employ McFarlane's conceptualization of assemblage given his focus on urban politics and everyday life which is in line with the overall research question as well as the sub-questions. McFarlane (2009,2011) uses the notion of assemblage as a way to understand the complex human relationships between the city as an everyday process of dwelling. Given the complexity and intricacies of relationships of power which go beyond simple networks of actor interactions, the concept of assemblages extends the analysis of power relations in terms of the depth of the connections and the synergistic impacts through the histories and experiences of their collaboration (McFarlane, 2009). Besides, since power relations are not simply networks wherein actors interact with each other, the notion of assemblage is useful in denoting the complexity and intensity of actor connections as it reveals how governance operates in perpetually changing environments.

McFarlane further contends that "assemblage thinking is attentive to both the individual elements and the agency of the interactive whole, where agency of both can change over time and through interactions" (McFarlane, 2011:253). Likewise, the constituent parts of the assemblage can be separated to generate other assemblages with different modes of interaction thus denoting assemblages as spaces of change and transformation. This particular attribute gives the concept of assemblage latitude to accommodate unexpected and unintended outcomes from actors with diverse stakes and interests in the process of water access. Disruptive changes in the pace of activities may necessitate reorganization thus demonstrating the distributive agency of individuals and groups (ibid).

In an earlier study, McFarlane (2009) suggests that assemblages are both an orientation and an object. As an orientation towards the world, assemblage is a way of thinking about issues and policies from the perspective of how different human and non-human elements combine, align and grow over time through uneven power relations. In contrast, the object perspective focuses on the "emergent, processual and

material" constructed through labour and different resource alignments that are constantly interacting and producing varying outcomes (ibid.:652). An example of an object assemblage is the physical and technical parts of water services infrastructure such as pipes, pumps and tanks. Both dimensions of orientation and object are relevant for this study given that it interrogates the views of the state and of the residents. Similarly, the idea that an assemblage is a collection of human and non-human components which structure how actors access resources and how they engage with everyday life is relevant for the extended notion of infrastructure as applied in this study.

The concept of assemblages is particularly relevant for this study given that, increasingly it is being used as a "descriptor of socio-material transformation" as demonstrated by the way that human and non-human interactions are splintered by inequality and exclusion as evidenced in access to water services (ibid.:206). Assemblages focus on how different actors transform processes through shifting power relations and hence help to describe the urban, and informal settlements in particular, as a collage constructed through processes and practices (ibid.). Thus, assemblages are sculpted through control of resources and power relations among various actors as well as the conflict between the ideal versus reality which in turn influences how urban inequality is created and experienced.

Secondly, assemblage is pertinent for this study due to its view of agency as distributed. According to Farias (2010:15) agency is "an emergent capacity of assemblages (...) it is the action or force that leads to one particular enactment of the city". Farias' notion of agency as related to assemblages is similar to that of McFarlane (2009) as it extends agency beyond human agency to consider non-human agentic influence in shaping urban spaces. Considering human and non-human agency in this study enabled a deeper understanding of water governance as an amalgam of both formal and informal components with distributed agency.

Besides, with the notion of distributed agency, infrastructure can be understood as process of changing relations, both human and non-human, within assemblages. Assemblages facilitate the investigation of both the individual agency and the collective agency of the assemblage as a whole since assemblages foreground the specific, and at times, surprising agency of diverse materialities. In order to access water services, residents engage in intricate relationships that cannot be adequately explained by simple networks but rather by assemblages that recognize all interactions both formal and informal.

Thirdly, given that assemblages are fluid and dynamic relations, they denote transformation in which actors are constantly configuring and reconfiguring relations (McFarlane, 2011). As the organization of the different elements and actors is constantly changing, assemblages demonstrate the hierarchy produced by uneven power relations, resources and knowledge which in turn generate inequalities in access to resources. The unequal power relations enable some actors to generate urban environments that are differentiated along gender, ethnic, class and race lines (Koster, 2019). The processual nature of assemblages - "how assemblage actually takes place: i.e., the processual everyday practicalities of dwelling, highlight the very acts of assembling themselves" Mc Farlane 2011:651.

McFarlane (2009) study of urban social movement in Mumbai, India, found that the concept of assemblage went beyond the conventional conceptions of space and power and was useful in explaining the operations of movements that included human (including their histories and struggles) as well as physical elements. Thus, the concept rendered itself relevant for the study of multiple actors and their practices and agency. Additionally, the idea of assemblage was useful in that study towards exploring who and what could effectively mobilize social movements. The study found that mobilization of social movements in Mumbai was dominated by the middle class who had access to resources, education and powerful social positions thus demonstrating that an assemblage is a power-mediated resource. Water services in informal settlements brings out the phenomenon of social materiality by examining the diverse human and non-human relations identified as the focus of this study.

McFarlane's (2011) notion of assemblage is related to Heidegger (1971) argument that dwelling is not about the technical dimensions but also the relations around an object linking spaces through an assembly (see Section 2.2.2). McFarlane argues that "the ways in which people inhabit the assemblage i.e. how they live through the varying forms of porosity and closure of the assemblage.(…) is the central point that shows (…) urbanism as a process of ongoing *dwelling as assembly*" (ibid.:658). Dwelling as defined by Heidegger (1971) actualizes assemblage which means that the everyday practices of dwelling manifest the very process of assembling. Dwelling connects private and the public spaces as well as the subject and the world. On the other hand, assemblage is "a way of approaching, understanding, or representing relations between multiple actors that are variously present or absent, near or far, interior or exterior, human and nonhuman (McFarlane, 2011:651). This connection is important for my study as it denotes how the assembling of infrastructure is a

continuous flux which reflects the reality of informal settlements in the global South. The next section appraises studies on the concepts of governance and the role of the state.

2.4 GOVERNANCE AND THE ROLE OF THE STATE

Though the term governance is widely used, there is no consensus on definition of the term. Authors such as Fukuyama (2013:350) define governance as the "government's ability to make and enforce rules, and to deliver services, regardless of whether that government is democratic or not". This definition has been challenged for taking a traditional view where the state is privileged as the sole proprietor and provider of public services. Other definitions have reduced the role of the government as the sole provider and implementer of policy by viewing governance as a collaboration between state and non-state actors such that state cannot take responsibility for all matters in the public sphere (Salamon and Elliott, 2002).

Likewise governance is seen as an alternative way of defining what government does in society and although the state has become less powerful in the recent past, it is still a dominant player due to the vast resources it controls while at the same time it cannot govern without the involvement of non-state actors (Pierre and Peters, 2005). The critical stance in this study shifts attention from government to governance because the view of governance as government is skewed towards a hierarchical orientation while this study focuses on capturing both horizontal and vertical interactions (Hufty, 2011).Urban governance in this study is viewed "as encompassing the multiple sites where practices of governance are exercised and contested, a variety of actors, various layers of relations and a broad range of practices of governance that may involve various modes of power, as well as different scales" (Lindell, 2008:1880).

The normative approach of "good governance" was an ideology promoted by the World Bank in the early 1990s emphasizing that more weight should be given to the private sector, civil societies and "rolling back" the state in decision making. It encourages participatory decision making, engagement of multiple actors in governance and application of professional private sector management, increase in accountability and transparency (Pierre and Peters, 2005). Good governance thus takes a prescriptive approach and thereby ignores the multiple interests and rationalities that characterize decision making (Cornea et al., 2016). This study did not engage with the concept of good governance because by prescribing an "ideal" mode of governance, it downplays critical factors such as the conflicts of interests that exist among the actors and were precisely prioritized as the focus of the study. Besides, the research question aims to understand things

as they are as opposed to how things should be. The notion of power is central in examining everyday interactions between various actors in the process of resource access. However, most normative governance studies do not engage questions of power largely due to the view that power-play is an inconvenience, a nuisance and a source of inefficiencies in the governance process (Benit, 2017). Given that governance is rooted in contestation, a normative approach to governance provides for limited contestation as it downplays the significance of centrality of power.

Analytically, the concept of governance is characterized as a process or an activity and is used to investigate the “less hierarchical -rather decentralized”, interactions between state and non-state actors and how they negotiate their interests (Zimmer, 2012 and Bierman et al., 2009:4). Governance is viewed as the ongoing interactions and negotiations between actors towards resolving complex and dynamic problems (Kooiman, 2003). Of interest in this study is the understanding of governance as the everyday interactions between actors at multiple levels and arenas thus enabling attention on both formal and informal interactions (Zimmer and Sakdapolrak, 2012). This study is built on the assumption that governance pervades all levels of society and therefore takes a non-normative approach to analyze governance processes. Taking the non-normative perspective implies that the study is not bound to a specific time or space thus allowing the analysis of the dynamics of interactions at different levels of society, spaces and time. By engaging the rules of the game, the agency-structure interactions are foregrounded thus revealing how norms enable or constrain actor-interactions.

Thus, this study argues that a non-normative approach enables the analysis of both formal and informal actors while encapsulating vertical as well as horizontal engagements in decision-making. This approach to governance seeks to understand the spatial practices in the city and places “the fleshy, messy and indeterminate stuff of everyday life" and social reproduction at the heart of urban governance studies (Katz 2001:711). Given that the failure of the state to provide adequate basic services has led to the emergence of “new actors, new structures” and new forms of engagement (Swyngedouw, 2005:1991), governance is conceptualized as “forms of steering that are less hierarchical -rather decentralized, open to self-organization and inclusive of non-state actors” (Bierman et al., 2009:4).

Since the aim of the study is not to predict the outcomes of the governance process, the interactions between various actors can be interrogated without prejudices. Non-normative approach thus allows the study to

capture and analyse everyday practices as they unfold without prejudicing/dismissing them upfront with labels/categories such as illegality or immorality as would be the case under a normative approach. This analytical view of governance was useful in understanding state and non-state actor-interactions and in theorizing the negotiation processes in water access in addition to capturing the messiness of urban governance and politics (Zimmer, 2012). It is this messiness that both provoked the study and therefore constituted the focus of what the study set out to investigate.

In order to adequately theorize power and water governance, the state must be featured particularly because the two sites under investigation are within countries in which access to water services is understood as a constitutional right. Besides, the state is a critical actor in water provision in both sites. Additionally, the history of contestation within the state or state-society relations is a product of water policies in each country that affect informal settlements (see Chapters 4 and 6). These histories shape local practices of how people continue to protest in their way or how they negotiate with power to enable them access water. Benit-Gbaffou (2017) argues that the relevance of the state has been questioned due to evidence of inefficiencies and lack of cohesion in processes of configuring urban spaces. However, examining the state is useful in analyzing and discussing the ability of the state to direct society and the response of society to interventions by the state in relation to water services as the focus of this study. While mainstream studies in water services governance assume the dominance of the state, this study foregrounds provision of water services through hybrid arrangements between state and non-state actors. The rest of the section appraises studies on the (in)visibility of the state in service provision.

Based on a study of organized and organic militia in Kenya, Ngunyi and Katumanga (2014) argue that imbalance in service provision is due to state absence as well as abstinence. State absence occurs when the demand for services exceeds the state's capacity to provide the services leading to a symbiotic relationship between the supply of services by informal providers and the 'demand' by the community. The wider the distance between the state capacity and the community's demand for the service, the greater the legitimacy of the informal service providers. On the other hand, state abstinence is a form of invisibility which (where the state that was previously providing a service but subsequently rolls back) which creates a service vacuum that is filled by informal service providers.

Thus, where there is state absence or abstinence, non-state actors perform a pivotal role in alternative service provision even when these actors are illegal or in conflict with the state. In the same vein, Borzel and Risse (2016:149) study on "areas with limited statehood where central state institutions are unable to effectively implement and enforce decisions", examined how services are delivered in spite of the limitations of the state. The authors argue that despite state absence, these areas are still 'governable' since governance does not solely depend on a properly functioning state. Further, informal institutions normally founded on trust, emerge and evolve based on the everyday experiences of the residents with the informal service providers (ibid). Trust therefore becomes the currency of the legitimacy of the informal providers. Additionally, they underscore the critical role of informal providers in service delivery in spite the dysfunctionalities of the state. This study therefore does not meld the concept of governance with that of the state.

As previously discussed, a non-normative idea of governance assumes different actors and multiple decision-making sites. The idea of neoliberal governance promotes the 'invisibility' of the state through the adoption of market-oriented approaches to reduce state spending in favour of privatized service provision (Brenner and Theodore, 2002). Neoliberalism advocates that economic development and service provision should be conducted in free markets with the state facilitating and regulating markets without direct involvement (Budds and Mc Ghanahan, 2003). Whereas the implementation of idea of neoliberalism in general began in the 1970s, its implementation in the water sector took place in the 1990s both in global North and South (ibid).

In the global South, the idea influenced policy reforms in the water sectors whereby financial institutions such as the World Bank and the International Monetary Fund (IMF) approached the reforms through their Structural Adjustment Programmes (SAPs) (Bakker, 2013) where privatization of public entities was a critical conditionality of the SAPs (ibid). Proponents of privatization argued that, given that the state did not provide adequate water services, privatization would extend the water distribution and make water affordable to all, and especially to the poor who had been excluded in service provision (ibid). However, the implementation of neoliberalism in water services provision has resulted in the exclusion of poor households (such as the residents of informal settlements) who cannot afford to pay the full cost of water (ibid).

In a study of community waste collection in Cape Town, South Africa, Miraftab (2004) found that whereas neoliberal practices made some individuals better off, the systemic basis (apartheid in this case) of poverty and oppression was left intact. She argues that empowerment through participation relied on the already

existing inequalities which led the residents to internalize their poverty because the poor material conditions did not permit them to exercise their participatory rights. She refers to the "paradox of neo-liberal governance: it uses the processes of symbolic inclusion, yet also relies on the processes of material exclusion" (ibid:239). This implies that through strategies such as cost recovery, participation can be used by the state to close resource gaps motivated by the need for budget cuts. Effectively, the state shifts its responsibilities to residents while making them believe that they are contributing to their own empowerment.

Razon (2017) put forward the idea of the politics of invisibility by the state which takes diverse forms such as silence, inaction or simply 'not seeing' so as to avoid addressing a problem. I argue that invisibility could produce contradictions in the state since what is 'seen' or 'unseen' by different levels of the state varies. Razon further argues that "seeing like the state refers to state officials employing a myopic lens to morph complex systems into simple and equivalent entities that could be legible to state agents" (ibid.:59). Given that what is 'not seen' lies outside the plans of the state, focus on what is 'seen' and 'unseen' could "provide a more complex understanding of the role of visibility in state practices" better understanding of governance could be reached by investigating the role of invisibility in state practices (ibid.56). The production and maintenance of invisibility is mediated by power relations and requires infrastructural conditions that shape and redefine the scope of the problem (Kuchinskaya, 2014). However, there are situations whereby phenomena that are clearly visible remain invisible because what is unseen can be neglected and therefore justified, attention should be given to "who and what counts as legible" (Razon, 2017:57).

Based on a case study on planning in Bangalore, India, Roy (2009) contends that the state maintains ambiguity and uncertainty through exceptionalism, deregulation and unmapping in order to create opacity about who is responsible for a particular space. Through the politics of unmapping the state alters land use in order to gain flexibility and fuel urban entrepreneurship by attracting investors through the accumulation of land value, speculation and granting subsidies. Moreover, unmapping provides flexibility to the state when it has no clear land use plan in place yet and to safely ignore the unmapped areasSimilarly, Caldeira's (2017) concept of transversal logics is useful in capturing the relationship between the residents and the informality of the state and complex layers of urban governance that are contingent and dynamic since it captures the intricate interactions between state and non-state actors. This idea of transversal logics suggests porosity and infiltration of public and private spheres into each other which allows the inter-movement between the 'public' and the 'private'. The state "regulates, legislates, writes plans, provides infrastructure, policies and

upgrades spaces (…) the state acts after the fact to modify spaces that are already built and inhabited" (ibid.:7).

2.5 ACTORS, POWER AND AGENCY

New ways of thinking and understanding governance can be reached by drawing attention to everyday life of infrastructural assemblages and how actors seek to control the infrastructure (Venkatesan et al., 2018; McFarlane,2011; Simone, 2015). Similarly, the delivery of urban water services is characterized by "multiple structures of power, multiscalar forces and can be used by particular power holders to reinforce their positions" (Cornea, 2016: 116). Actors are therefore central to governance and offer a variety of norms for instance on how leadership is embedded and practiced in a particular context (Kooiman, 2003). An actor is "any social unit possessing agency or power of action" and may include individuals, associations, leaders, firms, departments and international bodies (Kooiman and Bavinck, 2005:18 and Kooiman et al., 2008). Actors can be state or non-state players depending on the degree of autonomy and control from the state. The multiplicity of players involved in the struggle and negotiations over socio-spatial processes creates an array of actors involved in decision making which extends governance beyond the confines of government (Miraftab, 2004). The diverse and often conflicting interests of the actors contribute to the volatility of governance.

The identification of actors is crucial given that each actor defines the problem at hand using a specific lens and from a different vantage point while simultaneously trying to manipulate the rules of the game to their favour (Hufty, 2011). Investigating actors and their roles in water services therefore implies taking cognisance of the fact that though the technical side of water services is important, equally significant is the social and political dimensions of the actors (Kamau and Gitau, 2004 and Bjorkman, 2015). Different actors have varying room for maneuver in decision making depending on how much power they possess. This is further elaborated in Chapters 5 and 7 in reference to the practices of residents in accessing water services. Power is particularly significant at the micro level which focuses on assessing how the limited range of choices available to the actors influences the decision-making processes.

Mann (2008) links infrastructure and state power to formulate the concept of infrastructural power which interlinks the capabilities of the state with technologies of infrastructure through which the state exercises power. He elaborates the two ways in which the state exerts power namely despotic power and infrastructural

power. Despotic power is authoritarian and repressive power through which a state obtains obedience from its citizens while infrastructural power refers to how states subvert societies to gain legitimacy (ibid.). He further argues that of the two types of power, infrastructural power creates relatively strong states given the legitimacy that the state gains. Additionally, where infrastructural power is weak the state relies on despotic power to achieve short term gains but subsequently long-term infrastructural planning becomes more difficult to achieve. The notion of infrastructural power of the state was particularly useful in this study for two reasons. Firstly, as 'capillary thinking' to explain how the state permeates society everyday through infrastructural power and secondly, as demonstrating the existence of multiple sources of power demonstrating that the state seeks to subvert and thus the state is not the sole agency with power.

Based on Mann's (2008), Wafer (2011) contends that engaging capillary thinking to infrastructural power provides logic on how power infiltrates through contestation among actors which is diffuse and present at all levels of society and views power as being dispersed as opposed to issuing from a single and centralized source. Mann (2008:357) initially defines infrastructure as "the routinized media through which information and commands are transmitted" but later broadens the definition to include transmission of physical materials and the relations that emanate during the transmission process. Wafer (2011) argues that infrastructural power is actualized when 'hard' infrastructure enables the infiltration of the state's capillary power through points of intersection in a network. In line with Simone's arguments of people as infrastructure, he states that people are nodal points of the networks as previously discussed in Section 2.2 (ibid).

Building on Mann's work on infrastructural power, Meehan (2014) uses the notions of tool power and power tool to denote the fact that infrastructure produces state power thus becoming a power broker. Based on the study of infrastructure in Tijuana, Mexico which revealed that the different formal, informal and self-supply sources of water coexisted with and also limited state power thus resulting in "uneven spatiality of state power", she argues that infrastructure reinforces state power as it can be used to exercise dominion (ibid.:215). However, infrastructure limits state power given the emergence of other power centres that are generated by the infrastructure. In other words, infrastructure creates alternative power spaces outside the confines of the state. Meehan further points out that power tool denotes the fact that infrastructure can be used as a means to exercise power while tool power expresses the idea that infrastructure in itself can be a source of power. Thus, the presence of infrastructure makes the presence of the state seen and felt.

The notion of human agency pervades this study and is instrumental in examining water governance in informal settlements. Agents are "collectivities sharing the same life-chances, [that] do have interests (in improving or protecting the latter) which are external to the roles yet can be pursued through them" (Archer, 1995: 257). Therefore, agency demonstrates the idea that people are empowered to take actions that shape their lives and enable them to cope, adapt, negotiate and influence the 'rules of the game' towards gaining access to basic services (Ballard, 2015). Agency is exercised differently by individuals and collectives because in exercising agency individuals may be interested in material, social or political goods while collectives might be concerned about voice, representation, mobilization and identity (Narayan and Petesch, 2007). There are diverse views on the extent to which the poor possess and exercise agency.

Bayat (2000, 2010) proposes the idea of quiet encroachment as an alternative outlook to examine the activism of the poor. Broadly, quiet encroachment is the "non-collective but prolonged direct action by individuals and families to acquire necessities for their lives in a quiet and unassuming though possibly illegal means" (Bayat, 2000:536). He argues that through quiet encroachment the subaltern who is marginalized by the state and the market can navigate the city and access basic services for survival. He illustrates the point by citing indigent households in Cairo or Teheran that illegally tap electricity or water to cope and assure continued existence (ibid). Corroborating Bayat's view, Holloway (2010) contends that "social change is not solely produced by activists but by the invisible daily activities of people" (ibid.:2). Both authors converge on the view that through the politics of social non-movement, the poor exercise agency in accessing basic services through practice and direct action and not necessarily through protests.

Miraftab's (2009) work on insurgent planning discusses the limitations of inclusive governance in the global South. Insurgent planning constitutes "purposeful actions that aim to disrupt domineering relationships of oppressors to the oppressed, and to destabilize the status quo through consciousness of the past and imagination of an alternative future' (ibid.: 44). For Miraftab the actions by the poor aimed at countering the state are deliberate and intentional contrary to Bayat's (2004) view that the actions are pragmatic survival strategies that people engage in without intending to be illegal. While the two studies could be deemed to differ on the intentionality of people's actions, the crucial insights they bring to this study are the practices that people employ in accessing water services and why they engage such practices.

In his work on the political /civil society binary Chatterjee (2004) argues that since ordinary people who comprise the political society are unable to access resources and influence decisions by leveraging their civil rights, they forge relationships of reciprocity through exchange of money, votes and favors with politicians and local influential leaders to meet their needs. Chatterjee identifies negotiations as the key feature of the political society by which people seek exceptions to the rules in order to access services. The residents "make their claims on government and in turn they are governed not within the framework of stable constitutionally defined rights and laws but rather through temporary, contextual and unstable arrangements arrived at through direct political negotiations (Chatterjee, 2008:57). Based on a comparative study of water services in Johannesburg and Mumbai, Bawa (2011) argues that since hydraulic infrastructure is politically governed, mediation between the marginalized and the state is critical to access resources. Further, the fact that some of the bureaucrats reside in the informal settlements and are therefore recipients of government services blurs the boundary between the state and society thus making the role of the bureaucrat straddle between the distributor and recipient classification (ibid). The arguments on the blurred boundaries between the state and society are useful but not sufficient. Attention still needs to be given to the different ways in which this blurriness affects negotiations for access to services as well as the various outcomes of the negotiations which is an element of this study.

Lund (2006) introduces the idea of public authority and twilight institutions as well as their emergence and operations. Twilight institutions obtain legitimacy by mimicking state like features while undermining the state simultaneously. Public authority is shared by a number of twilight institutions as they work towards gaining legitimacy such that the distinction between state and society is blurred. He further argues that public authority is devolved to other institutions that imitate the operations of the state. Building on Lund's (2006) and referencing a study of water services in Mumbai, India Ranganathan (2014) argues that the concept of public authority is useful because it foregrounds the relational dimension of how power and public authority can be understood from below by examining the encounters of everyday practices and the different modes of public authority. The idea of public authority calls to attention the alternative relationships of the formal state through informal sovereigns such as cartels, the street level bureaucrats and local community representatives (ibid.).

Equally, in a study of urban land transformation in Indian cities, Benjamin (2004) found that the poor are more effective through porous bureaucracy and politics of stealth which entails incremental changes that are not

radical, but which are effective. Thus, rather than 'fight' for their rights, they achieve greater success if they secure favours from the local bureaucrats. The incapacity of the state to deliver basic services creates porous boundaries and spaces for engagement between the state officials at different levels and non-state actors. Similarly, in a study of water services in Bangalore, India, Ranganathan (2014) found that 'water mafias' exercised public authority and distorted the discursive demarcations between the public and the private; and the legal and illegal. Through making and breaking boundaries water mafias serve other functions such as social protection, welfare provision and electoral campaigns in addition to service provision thus moving in and out of the political-civil society duality suggested by Chatterjee (ibid.). Of use to this research is Chatterjee's points on how the marginalized maneuver access to resources.

Seligman (1975) proposed the theory of learned helplessness to describe situations whereby individuals perceive a lack of control over their situation leading them to passively give in and resign to their situation. He argues that previous extended exposure to inescapable adverse situations weakens the ability of an individual to subsequently respond in order to escape adverse events even when it was possible to do so. Learned helplessness is "the interference with adaptive responding produced by inescapable shock" (Seligman, 1972:408). The inability to learn is caused by the failure to see a connection between a response and the trauma because of the emotional stress that accompanies the realizations that the trauma is beyond one's control. The helpless person is unable to learn that a response could produce positive results to make the situation better leading to a preference for coping rather than for proactive behaviour. Thus, the notion of learned helplessness will be useful in this study to explain how residents perceive their agency to transform stressful situations induced by protracted water scarcity.

The discussions above demonstrate diverse views which suggest that there are varying degrees of agency among the poor but they do not tell us how intersectionalities such as gender, race, employment and migrant status influence the level of agency. This study therefore interrogated how such factors influence the negotiations for water access within households and communities especially when coping is viewed as one of the ways through which agency is exercised rather than an implication of having given up. The next section will present Bourdieu's field theory which was used in the study to enrich the analysis and understanding of power and social relations through identification of actors in the field, their practices and the rules they employ in the field.

2.6 BOURDIEU'S FIELD THEORY

The French sociologist Pierre Bourdieu (1930-2002) developed the field theory which has significantly contributed to the analyses of societal power dynamics. His work was largely influenced by philosophers such as Aristotle, Hegel, Heidegger, Karl Marx and Durkheim among others. According to Connolly, 1998:71, Bourdieu's field theory is a useful analytical tool in deepening our understanding of human behaviour through examining how "various discourses impact upon the individual". His theory gives a set of thinking tools that could be used to create a cocktail of concepts capable of capturing the messiness of empirical phenomenon in order to address a related research question. The theory was relevant for this study as it facilitated for the extension of analysis of water beyond the economic dimension and thus encompass cultural and symbolic capital aimed at a richer analysis of governance. Bourdieu's theory can be applied as a theoretical underpinning of relational power and conceptualization of social relations in access to water services because it foregrounds the messiness inherent in governance practices and negotiations which occur in power-laden spaces (Zimmer and Sakdapolrak, 2012). It is this messiness that is both the primary subject of interest and concern of this study.

Although the field-theory based framework has been applied to analyze various phenomena such as community security (Katsaura, 2013), and wastewater (Zimmer and Sakdapolrak, 2012), only Zug (2015) has applied Bourdieu's framework to analyze water services in an urban context. The field theory is pertinent in capturing the relational dimension of access to water services that looks at "how power circulates through social-hydraulic landscapes (…) power is an effect of a myriad of relations not something that can be held" (Ekers and Loftus, 2008:700). Hence power influences when, where, how and how much water will flow through the city (ibid.). For instance this can be applied to the apartheid city planning in South Africa, the impact of which will be discussed in Chapters 6 and 7. In order to delve deeper into thinking about the microspheres of negotiation of water access, I choose the notions of the field, habitus, practice and doxa from Bourdieu's array of thinking tools.

Bourdieu (1984) defines a *field* as a social arena of struggles whereby actors with unequal levels of power compete over the appropriation of various species of capital. Swartz defines fields as "arenas of production, circulation, and appropriation of goods, services, knowledge, or status, and the competitive positions held by actors in their struggle to accumulate and monopolize these different kinds of capital" (Swartz, 1997:117). This definition is useful as it encapsulates the different types of capital that might be present in a field and

are thus at the centre of the contestations. The concept of field is fluid and dynamic which means that it has to be redefined for each empirical application.

For purposes of this study, water governance was prioritized as the field and is characterized by diverse actors and power asymmetries. Moreover, the notion of field is suitable for the analysis of diverse and semi-autonomous communities as those found in informal settlements which constitute the subject of investigation in this study (Katsaura, 2013). Thus, the water governance field is an arena for access to a variety of resources through the contestation of various actors. Bourdieu sees society as comprising of relatively similar but homologous fields with wide ranging interactions between power structures and practices (Katsaura, 2013).

The term homologous field indicates that dominant actors in one field tend to dominate other fields. For instance, those who dominate the water governance field also dominate other fields such political, economic and land tenure indicating corresponding power configuration between fields. Besides, as governance of water services is a relational field of struggle, field analysis highlights the various power centres at play in water services by investigating the various actors and their interactions at different levels thus moving beyond the bureaucratic state (Zimmer and Sakdapolrak, 2012).

Habitus is the actors' cognitive mind map that governs behaviour, a 'structured structure' produced from the field which at the same time structures the field as it configures it (Bourdieu,1977 and Bourdieu,1990). Habitus structures how people interact with each other and their views of the world which is a product of their history and socialization (Bourdieu,1990). Habitus is a useful concept to explain actor practices which can be understood as repeated acts and attitudes of agents that become habitualized over time (ibid. and Katsaura, 2013). Bourdieu explains habitus as "structured structures predisposed to function as structuring structures that is as principles which generate and organize practices and representation" (Bourdieu, 1990: 53). Building on Bourdieu's work, de Certeau (1984) in his work *The Practice of Everyday Life* discusses two concepts with regard to everyday life: strategies and tactics. He defines strategies as all the hegemonic structures whose existence depends on the production of power space. Tactics, on the other hand, are developed not in support of strategies but to interfere with the power structure. Bourdieu's thinking provides a useful tool for understanding people's interpretation of their daily life experiences. Habitus influences the contestation for various types of capital by the respective actors involved in a field. The notion of habitus as elaborated by

Bourdieu converges with the idea of dwelling by Heidegger (1971) discussed in Section 2.2.1 in that both are generative of relations between actors. Of importance to this study is the fact that dwelling is not static as it is actualized through the everyday practices of various actors.

Capital is what is of interest in a field or what is sought after by the various players (Bourdieu, 1984). The types of capital salient in urban governance include political, social, economic and spatial capitals (Bourdieu 1986; Katsaura, 2013). Economic capital is cultural capital as accumulated history, language that is embedded in the habitus which certifies our dispositions. Social capital is the "existence of a network of connections which is not a natural given (...) constituted once and for all in an initial act of institution" (Bourdieu, 1986:249). McFarlane (2011) notion of assemblages previously discussed denotes various social relations between actors and how they evolve over space and time. Equally, the social space is the arena where people are relationally positioned depending on their access to capital (Zug, 2014). Political capital is ingrained in the habitus in the array of political skills that enable people to play their roles effectively. Bourdieu further points out that given that this capital is built on symbolic recognition, it is fragile because it is dependent on the leader's conduct and the perception that others have of him (Bourdieu, 1984). The inter-convertibility of the different forms of capital demonstrate the mutual dependence and interconnectedness of the various species of capital. For instance, local communities often convert social capital to political capital in order to gain political influence (Birner and Wittmer, 2000). Furthermore, it is objectified or measured through the number of votes; institutionalized through the use of titles and formal mandate in governmental and NGOs structures (ibid.).

Political legitimacy is a consequence of political capital that can be amassed, invested, gained or lost (Benit-Gbaffou and Katsaura, 2014). He points out that community leaders gain legitimacy and political mileage through election by constituents or nomination by (in)formal institutions. Further it is important to examine the connection between the leader's legitimacy from the bottom as gained through local groups and constituents versus the legitimacy from the top as acquired from institutions (ibid.). As will be discussed in depth in Chapters 5 and 7, this connection is crucial because oftentimes, community leaders execute their responsibilities between layers with varying degrees of formalization thus acting as mediators between the local community and state or non-state institutions. Additionally, also compete with fellow leaders in order to enhance such recognition from the community and institutions.

Bourdieu further argues that *practices* are generated by the interface between habitus, capital and field, and as such, although habitus plays a significant role in the practices of everyday life it does not influence solely in isolation (Bourdieu, 1990). The notions of field and capital are relevant in examining "governance processes as negotiated practices" given that individuals are seen as actors who through their practices and capital jockey for position in the field (Benit-Gbaffou and Katsaura, 2014:328).The uneven distribution of the various capitals creates a skewed playing field primarily characterized by actors with asymmetrical power relations where the rules of the game are formulated by the most powerful actors.This theory relationally examines agency and structure by focusing on linked practices as well as the connection between related agents thereby providing a nuanced multilayered understanding of structures and agents (Bourdieu and Wacquant, 1992).

Bourdieu (1984) uses the term *doxa* to refer to written and unwritten prescripts that govern practices, influence the power relations as well as the distribution of resources in the field. People apply doxa, in the form of social rules which in turn reflect people's view of the world. Standing in the form of rules of the game, doxa imply "an adherence to relations of order, which because they structure inseparably both the real world and the thought world are accepted as self-evident (ibid., 1984:471). In theory, agents are more likely to share a particular doxa while in practice they may not always agree on the doxa, with each seeking to alter or conserve the forces of the field and alter the rules of the game in their favour. It is difficult to agree on the intentions across the different players prompting contestations. Likewise, Hufty (2011) argues that through actors-practices, social norms that are dependent on the power of the actors, their interests and history are formulated. Actors exercise agency within the boundaries of the structures of social norms and customs.

Social relations are the arenas where the actors compete for resources and are the outcomes of power relations thus making field and practices to be intrinsically linked. Effectively, rules and regulations become tools that are employed by states to pursue their interests (Zimmer and Sakdapolrak, 2012). Equally, Bourdieu's theory is useful in extending our understanding of the rules towards identifying the contradictions between the formulation and implementation rationalities since it is impossible to formulate rules for in detail enough to cover every situation. Residents use diverse tactics to deal with low ranking state officials or street level bureaucrats to influence their behaviour with regard to complying to certain rules such as paying bills or exemptions of the rules such as making instalment plans for outstanding payments. The state controls water services in a particular territory through various legislations and regulations. Bourdieu (2006) argues

that state actors are often expected to be impersonal, rational and neutral players while delivering public services. By contrast, Simone (2016) in writing about the practices that residents engage to cope with volatile urban conditions argues that rules are often unclear and impractical since they are distilled through the interests of the powerful leaving residents at loose ends. Consequently, residents maneuver the city through "–waiting, fighting, advocating, dealing, manipulating and giving" with state actors (ibid., 7).

Social norms are produced by the interactions between the actors and are in turn reconstructed and reshaped by the practices and the behaviour of actors (Giddens, 1984). Structuration refers to the interaction process between the agents and structure or norms (ibid.). In analyzing social norms, it is important to establish what the rules of the game are and the process by which they are formulated. The norms could either be legal, formal or informal. Legal norms are sanctioned and codified by the state and would include specific acts of the law. Formal norms are agreed upon and recognized by specific actors or social groups while informal norms arise out of practices by actors without involving explicit record (Achwoka, 2016). Furthermore, given that governance is multi-layered, formulation and enforcement of norms at various levels comprise the key reason for the contestations among actors since some of the norms may be conflicting.

Bourdieu points out that at different levels and facets the state is a dominant player in governance. I agree that the state is a salient direct actor in informal settlements largely due to the perception by other actors that the state has the requisite resources to make water available. The fact of being the holder of mega capital gives the state the capacity to dominate other actors in the socio-political arena. He states that:

> "The state is a culmination of a process of concentration of different species of capital: capital of physical force or instrument of coercion (army, police), economic capital, cultural capital or (better) informational capital, and symbolic capital. It is this concentration as such which constitutes the state as the holder of a sort of meta capital granting power over other species of capital and over their holders" (Bourdieu, 1998a: 41).

The state may exist far from people in terms of the bureaucracies but still be close to people such that in their minds as well as their everyday engagements, people think through, with and against the state (ibid.). Besides, even when the state is present, the state often abstains from making certain decisions and taking actions due to the complexity of the problem at hand. This argument is in line with Simone's (2015) ideas on norms and rules that they are often tools of silencing residents by prescribing how things should be done

which thus transforms rules into instruments for judgement of behaviour of the individual. Thus, investigating state absence and abstinence could deepen our understanding of how the residents of informal settlements navigate everyday life to access water services.

2.7 COPRODUCTION

The concept of coproduction is relevant to this study given that it moves away from binary and normative classifications of service provision thus giving better insights of the options of water services provision. The origin of the concept of coproduction is attributed to the collaborative scholarship of the 1970s by the American political economist Elinor Ostrom and Vincent Ostrom, a political scientist. They utilized the notion of coproduction to explain the increase in crime rates in Chicago when police disengaged from the everyday lives of people on the streets and relied more on conducting surveillance patrols in police cars. In their view, this led to a loss of crucial and decisive insider information that would have been useful for combating crime. Although disciplines such as development studies, public administration and political economy have engaged the concept of coproduction since the mid-1990s, it is only recently that it has gained currency in urban studies as an approach to deliver services and promote social justice in marginalized areas where the state lacks the capacity or willingness to deliver (Joshi and Moore, 2004, Watson, 2014 and Mitlin and Bartlett, 2018).

Ostrom defined coproduction as the "process through which inputs used to produce a good or service are contributed by individuals who are not "in" the same organization" (Ostrom, 1996:1073). Research projects in urban studies such as Watson (2014), Olumuyiwa (2016) and Lines and Makau (2018) have focused on the application of coproduction in material interventions in service delivery to informal settlements while others such as, Munoz and Miller (2017) and Perry and Atherton (2017) have addressed coproduction of knowledge infrastructure through which multiple actors jointly identify problems, determine a feasible solution and implement it. Voorberg, Beklers and Tummers (2015) contend that even though the concept of coproduction has been applied in sectors such health, education and garbage collection, it has rarely been applied in the case of water governance and management due to the direct encounters between producers and consumers in these services as opposed to similar relationships in water services.

Coproduction is driven by governance (failure of the government to provide services) and logistical (context specific) factors. Mitlin (2008) argues that coproduction is an avenue for residents to expand their political

latitude and to increase their ability to engage the state to access basic services. Miller and Wynborn (2017) recognize that the state cannot produce all services on its own and therefore public services whether collaborative or contested are borne of a joint effort. For Ostrom et al. (2005:3) coproduction does not eliminate power imbalances neither are the goals of the various actors necessarily aligned since it "is joint work to fashion a joint world cooperatively and through coercion and resistance". In line with previous discussions by McFarlane (2009) and Bourdieu (1986) coproduction involves power relations and collaborations as well as contestations inherent in assemblages and social relations. This study explored the practice of coproduction in the governance of water services by examining how the actors interact and engage each other in the process of provision of water services.

Coproduction enables access to services through state and citizen collaboration as well as amplifying citizens' ability to engage the state. Therefore, coproduction is preferred in cases where behaviour change is envisioned and participants' views and experiences are required for effective service delivery (Mitlin, 2014). Mitlin further points out that in practice, coproduction is an attempt to look beyond the limitations of a Weberian conception of the omnipresent and omniscient state and therefore recognizing that the state has to interact with other players with varying levels of power and knowledge. The resultant power distribution between organized citizens and the state in coproduction therefore needs to be investigated as well as how new and improved modes of service delivery based on local practices can be created.

Mitlin and Bartlett (2018) argue that coproduction is about bridging the existing power inequalities through inclusion of people such as the diverse actors in informal settlements who would otherwise be excluded from discussions and decision making. However, Ahlers et al. (2014) contend that coproduction can translate into a process that often produces conflict due to the power imbalances between the various actors. For example, in the case of water services, contestation may arise over the sources of water, the distribution network and the infrastructure that should be used thereby changing the mode of service provision continuously. Equally, inasmuch as coproduction is aimed at empowering local communities, it could lead to unintended consequences such as takeover by local elites thus excluding such communities from access to services and rendering them to become even more vulnerable. In addition, projects may be entrusted to local communities who are unable to run them effectively due to lack of managerial or technical skills. The practice of coproduction involves both state and non-state actors with unequal power who often contest and negotiate their intentions as well as interests in order to reach an agreement or consensus on delivery goals and

processes. The study of coproduction thus entails the revealing of the capabilities of the state and limitations at different scales and levels (ibid).

Coproduction augments collective action by moving towards the creation of working relations and collaboration between groups in addition to challenging particular dimensions of governmentality such as reducing the state's capacity to control individuals (Mitlin, 2008). However, as civil society gathers information about the state processes during coproduction, it also enters governmentality spaces thus taking up the state's oppressive practices. Although service delivery costs may decrease, the process may not necessarily contribute to better democratic practices. Mitlin further argues that there is need to decentralize decision making on service provision as a "process of social construction in which actors … negotiate rules, norms …rather than taking rules as given" (Bovaird, 2007 cited in Mitlin, 2008:357-8). Therefore, co-production causes shifts in power and changes relationships as well as structures in service delivery.

Ahlers et al. (2014) argue that (in)formality is not so much a question of the practice as it is of the authority to validate the practice. In a similar vein, Ranganathan (2014) argues that a better understanding of informality could be obtained by examining the public authority exercised and social power dynamics that influence the validation of the practice as opposed to merely focusing on the practice itself. Urban informality is an "organizing logic, a system of norms that governs the process of urban transformation itself" (Roy, 2009:148) and is "at the very heart of the state and is an integral part of the territorial practices of state power" (ibid.:84). Coproduction is therefore the amalgamation of formal and informal modes of service delivery as opposed to the use of the formal-informal binary and therefore could form the basis of a better understanding of service provision in informal settlements.

Although Ostrom premised coproduction on a properly functioning state and organized communities, in reality, coproduction is primarily practiced in contexts where these two assumptions do not hold (Watson, 2014 and Olumuyiwa, 2016). Likewise, Mitlin's focus on coproduction relates to cooperation between the state and locally organized groups. However, some scholars have argued that coproduction has led to low satisfaction of users due to mistrust and lack of full disclosure of information about the outcomes and their impact among actors (Fledderus, Brandsen and Honingh, 2015). While coproduction is aimed at being inclusive and addressing inequality, it could generate unintended consequences such as increasing the

vulnerability of communities due to takeover by criminal/racketeering forces thus generating additional layers of exclusion and further reinforcing inequalities among users (Olumuyiwa, 2016).

Ostrom (1996); Joshi and Moore (2004); Watson (2014) and Mitlin and Bartlett (2018) corroborate on their view that coproduction is a deliberate and intentional process toward the achievement of service provision goals. Adapting Cornwall (2000 and 2002) typology of invented and invited spaces for participation, I argue that coproduction may also be spontaneously emergent or invented as an alternative mode of service provision. Deliberate and intentional coproduction is the consequence of logical and systematic rationalization of the process and outcomes of coproduction as a mode of service delivery. On the other hand, emergent coproduction is generated by the everyday interactions, activities and processes which do not arise from conscious planning but out of patterns of behaviour which, over time, generate a new way of doing things and finally consolidate into the normal practice (Mintzberg and Waters, 1985). Intended strategies for service delivery are the result of careful, rational and logical planning and may not always be realized as envisioned. Thus, the realized outcome is the result of everyday practices that are emergent and aspects of the intended plan that may have been accomplished (see Figure 2.4). Both the invited and invented spaces of coproduction can coexist during various stages of the process making the boundaries between the two spaces blurred largely due to the variety of actors involved. Based on the findings of this study, I argue that coproduction may also be regarded as a coping mechanism by the state when it is unable to deliver services as it envisioned due to lack of willingness or capacity to deliver services.

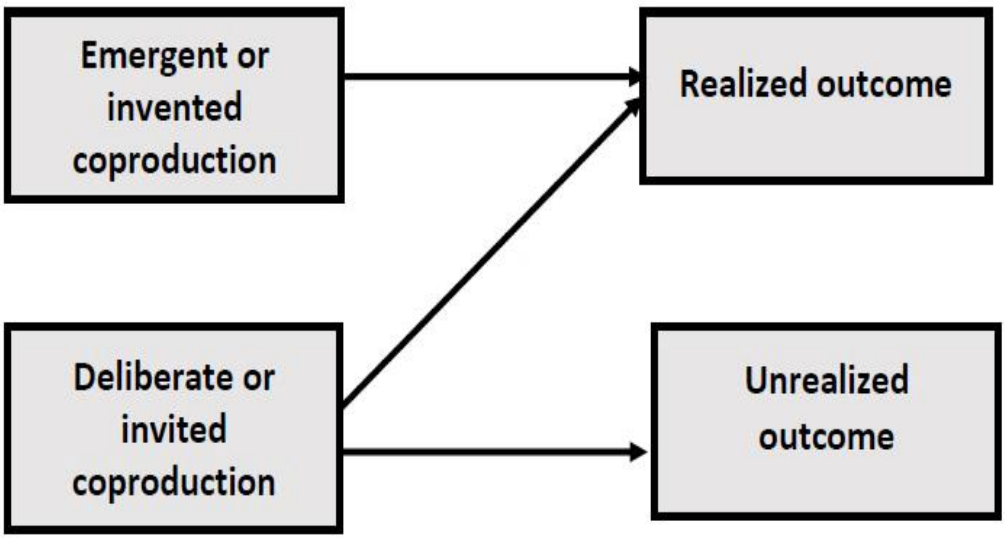

Figure 2.2: Typologies of coproduction (Source: Author, 2020)

2.8 CONCEPTUAL FRAMEWORK

Based on the literature reviewed on the notions of infrastructure, actors, governance and coproduction, a conceptual framework was developed to demonstrate the connection between the different elements of the study. A conceptual framework is a representation of the "key factors, constructs and variables being studied and the presumed relationship between them" (Gray, 2009:174). It is a personally constructed provisional theory which is specific to the study in question. Miles and Huberman (1994) state that a conceptual framework provides a focus for the study by establishing the boundary of what is to be studied, what will be omitted and the hypothesized relationship between the variables. Ravitch and Riggan (2017) argue that the conceptual framework outlines the direction of the research and guides the study as it develops. Further, they opine that a conceptual framework is a useful tool for organizing ideas and concepts of the study.

Figure 2.3 represents the initial conceptual framework in terms of the different domains of the study and their hypothesized relationships. Following the derivation of findings, the conceptual framework was (re)conceptualized/updated as shown in Chapter 9, Figure 9.2. Based on the first sub-question conditions and challenges of water services), insights on the status quo of water services was gained through the infrastructure lens which examines the assemblage of human and non-human components of the infrastructure. The infrastructure lens revealed how people relate with the infrastructure and the role that infrastructure plays in social relations. Infrastructure is made up of the water distribution systems (the material component), people (social relations), knowledge as well as regulations and laws (see Figure 2.3). These elements of the infrastructure mediate governance processes but at the same time governance influences hydraulic infrastructure. Thus, gaining and maintaining access to water services is a (re)negotiated process that is mediated by infrastructure both in form and flow of water.

Based on the second sub-question (state and non-state actors in water services) governance is understood as an assemblage of formal and informal interactions between state and non-state actors who exercise differing levels of agency. The outcome of the negotiated interactions among various actors for water access, use and disposal depends on the agency and the sources of power that each actor draws on (Torfing et al., 2012). Likewise, the assemblage of actors involved in water services and their interests contribute to the fluidity and unpredictability of governance. The diverse responses of actors in their roles and practices as well as the conditions and challenges of access to water services render the normative mode of water governance highly malleable during access and induce non-normative governance modes characterized by

shifting rules of the game which create the critical fluidity and space for (re)negotiated access. Equally, the agentic properties of material infrastructure and the embeddedness of human bodies in the process of water access are enhanced beyond what would normally be envisaged under normative mode of governance. The third sub-question on practices of access to water services, use and disposal) suggest that some of the practices are anchored on coproduction which is laden with power imbalances and involves power relations, collaborations as well as contestations inherent in assemblages and social relations. Thus, exploring coproduction influences the governance of water services in the interactions and engagements of actors in gaining and maintaining access to water services.

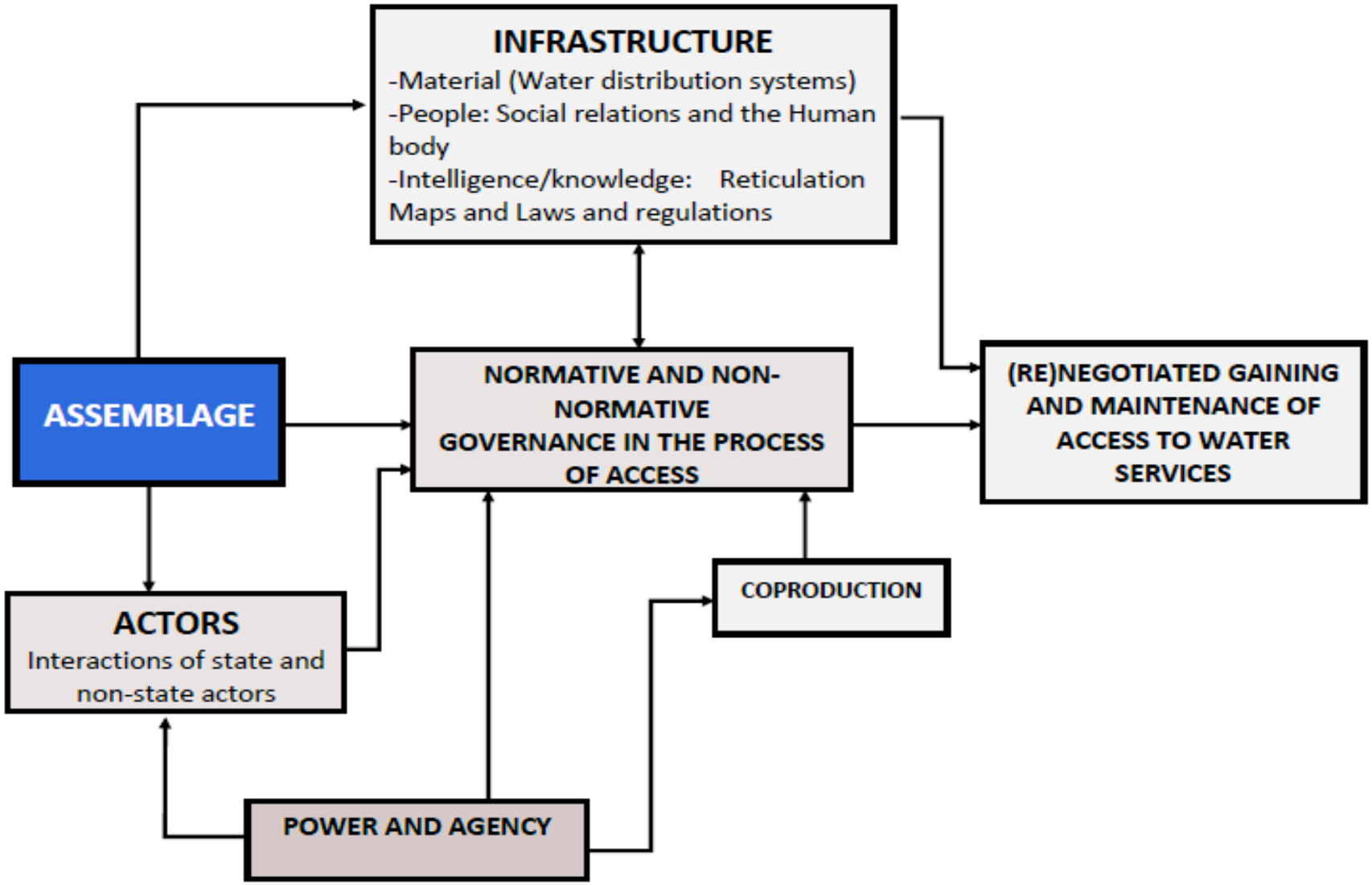

Figure 2.3: Conceptual framework of the study (Author, 2021)

CHAPTER THREE

3 RESEARCH DESIGN AND METHOD OF STUDY

Fieldwork is about 'mixing with people and encountering moments...[and then] writing accounts of the encounters as some form of "data," and thinking about their meaning and theoretical import' (Emerson, 2001:x).

3.1 INTRODUCTION

The research methods of this study provide the bridge between the conceptual framework discussed in the Chapter 2 and the field work conducted in order to answer the research question and sub-questions. This Chapter discusses the research design and methods employed in the study, my motivation for utilizing these approaches and the challenges encountered and how they were managed. I chose to utilize a case study research strategy with multiple data collection methods to construct descriptive case studies. The Chapter therefore covers the research design, the research strategy, the data collection methods and data analyses and interpretation techniques. A discussion on the political dimension of the fieldwork with regard to gaining access will be presented to demonstrate the fact that whereas conscious effort was made to remain objective and impartial throughout the fieldwork, my experience proved that research is by its nature political and subjective.

In line with Emerson's quote above, the fieldwork entailed 'mixing with people' and 'encounters' which generated the data for the study. The 'mixing' and 'encountering' took place in the two purposely selected case study areas - Mukuru in Nairobi, Kenya, and Kya Sands in Johannesburg, South Africa. Chapters 4 and 6 presents detailed descriptions and discussions of the study contexts. However, a brief overview of the study contexts will be presented in this chapter as well as the criteria for selecting them. Reflections on my positionality and how it affected the data collection process, analyses and interpretation will be elaborated. The link between the research questions and the data collection methods chosen is also presented. The Chapter ends with an explanation of the ethical considerations of the research as well as how the ethical dilemmas encountered in course of the study were addressed.

3.2 RESEARCH METHODOLOGY

The research design was aimed at accessing ad presenting data that meet two objectives: firstly, to engage with the residents of the informal settlements in a meaningful way so as to uncover their experiences and perceptions of water services and secondly to affirm, contest or reject my theoretical conceptualization on the significance of power relations on water access, use and disposal in informal settlements as informed by existing studies to date (Kornienko, 2013). Anchoring on an ontological philosophy that explores the nature of reality, as well as people's perceptions of their reality and how they affect behavior, this study applied an interpretivist lens. Besides, given that interpretivism research seeks to gain insights and in-depth information about a social or human phenomenon, qualitative research was more suitable to capture experiences and understandings. Furthermore, such research,

> "consists of a set of interpretive material practices that make the world visible. (…) They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings and memos about self. …. qualitative research involves an interpretive, naturalistic approach to the world. (...) researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings that people bring to them" (Denzin and Lincoln, 2005:3).

Qualitative research was useful towards an understanding and description of social phenomena through interactions with the residents who know, experience and understand their locale. Equally, the approach gave me the opportunity to clarify the power relations in water services provision through a deep inquiry of the salient water governance issues (Flick, 2007). A qualitative approach also brought to the fore the nuances and perceptions of the unspoken and hidden meanings that residents attached to their experiences. Thus, the choice of a qualitative approach was therefore both pragmatic and rational as it was the most appropriate to the problem setting and the objectives of the study. Most importantly, it gave voice to the often-voiceless people living in informal settlements by allowing them to share their experiences of and narrate their encounters with water services (Stein and Makowski, 2004). Thus, the qualitative design facilitated the revealing of experiences, understandings and perceptions of individuals and households especially when guided by the rationale that social phenomena would be best understood within the real context in which they emerge. In order to contextualize the research methods, the study utilized the 'research onion' metaphor by

Saunders, Lewis and Thornhill (2012). The five layers of the 'research onion' as applied in the study are summarized in Table 3.1.

Table 3.1: Summary of research methodology using the 'research onion' metaphor (Author, 2020)

Layer	Method	Description
Research philosophy (how data will be collected, analyzed and used)	Interpretivism	Exploring people's ideas, practices and meaning-making about water services.
Research approach	Deductive/inductive	Moving from theory to research question and from the data to the theory.
Research strategy	Case study	Observing a single unit for salient features.
Research time horizon	Cross sectional	Studying a specific phenomenon at a single point in time.
Research data collection methodology	Primary and secondary data collection methods	Direct observation, interviews, key informant interviews, transect walks, documentary analysis

With the view of addressing the research question adequately it was necessary to engage in the finer details of the observed practices. This entailed moving the focus from broad brushstrokes in understanding the multiple complex conceptual structures to looking at the fine lines in order to enable the construction of "thick descriptions" (Geertz, 1973). A thick description,

> "… does more than record what a person is doing. It goes beyond mere fact and surface appearances. It presents detail, context, emotion, and the webs of social relationships that join persons to one another. (……). It inserts history into experience. It establishes the significance of an experience, or the sequence of events, (……) the voices, feelings, actions, and meanings of interacting individuals are heard" (Denzin, 1989:83).

Besides, they include the context and relationships that explain the discourses of a society as well as the context of practices within which the observed behavior is interpreted (Denzin, 1989; Ponterotto, 2006). Thick descriptions depict the meaning and interpretation of the intentions related to the observed participants' behaviour. Overall, thick descriptions that were necessary to enhance the understanding of the research contexts were fully based on qualitative data (Ponterotto, 2006).

3.2.1 Case Study Strategy

According to Flyvbjerg (2011:314) "… if you want to understand a phenomenon in any degree of thoroughness - say, child neglect in the family or cost overrun in urban regeneration - what causes it, how to prevent it, and so on, you need to do case studies". The case study approach gives a rich understanding of the context under investigation and the processes enacted therein by answering 'why, what and how' questions and is suitable for investigating "contemporary phenomenon of "the case" in its real-world context especially when the boundaries of the phenomenon and context may not be evident" (Yin, 2009:18). A case study is suitable when "the investigator has little control over the events and when the focus is on contemporary phenomenon within a real-life context" (ibid.:2). The "how" and "why" questions are exploratory in nature as they are aimed at establishing how things function over a period of time rather than tallying incidence. I sought to investigate the conditions and challenges of water services in the informal settlements by deepening my understanding of the "how" and the "why" behind the complex social phenomenon I was observing in a real-life setting over which I could not exert meaningful experimental control. The three priorities therefore persuaded me that a case study approach was the best option for exploring the research topic and achieving the expected understanding or insight.

The "case study's unique strength is its ability to deal with full variety of evidence – documents, artifacts, interviews and observations- beyond what might be available in a conventional historical study" (Yin, 2009:11). The use of a mix of data collection methods enables triangulation of research findings while capturing the complex reality of the phenomenon under study from multiple perspectives (Denscombe, 2010; Saunders et al., 2012). Multiple data collection methods were employed so as to adequately address the research question. The purposely prioritized case studies provided the empirical context for capturing the distinct experiences of residents of informal settlement in Johannesburg and Nairobi.

3.2.2 Research Site Description- Mukuru and Kya Sands informal settlements

Study site- Mukuru

Mukuru is located approximately 8 km southeast of the Central Business District (CBD) of Nairobi and is one of the largest informal settlements in the city. It comprises of three distinct areas which are Mukuru kwa Reuben, Mukuru kwa Njenga and Viwandani (see Figure 3.1). The three areas fall under three distinct administrative wards which are Viwandani, Imara Daima and Mukuru kwa Njenga (International Development Research Centre, IDRC, 2017). The Nairobi County Government gazetted Mukuru as a Special Planning Area (SPA) in August 2017 declaring it an area with "spatial or physical development problems that require immediate attention of the government" (Government of Kenya, 2012:8). Unlike other informal settlements in Kenya, Mukuru has a diverse ethnic population without a communal claim by any ethnic group as nearly all the 42 indigenous Kenyan communities live in the informal settlement (IDRC, 2017). Further details on Mukuru informal settlement are presented in Section 4.2.

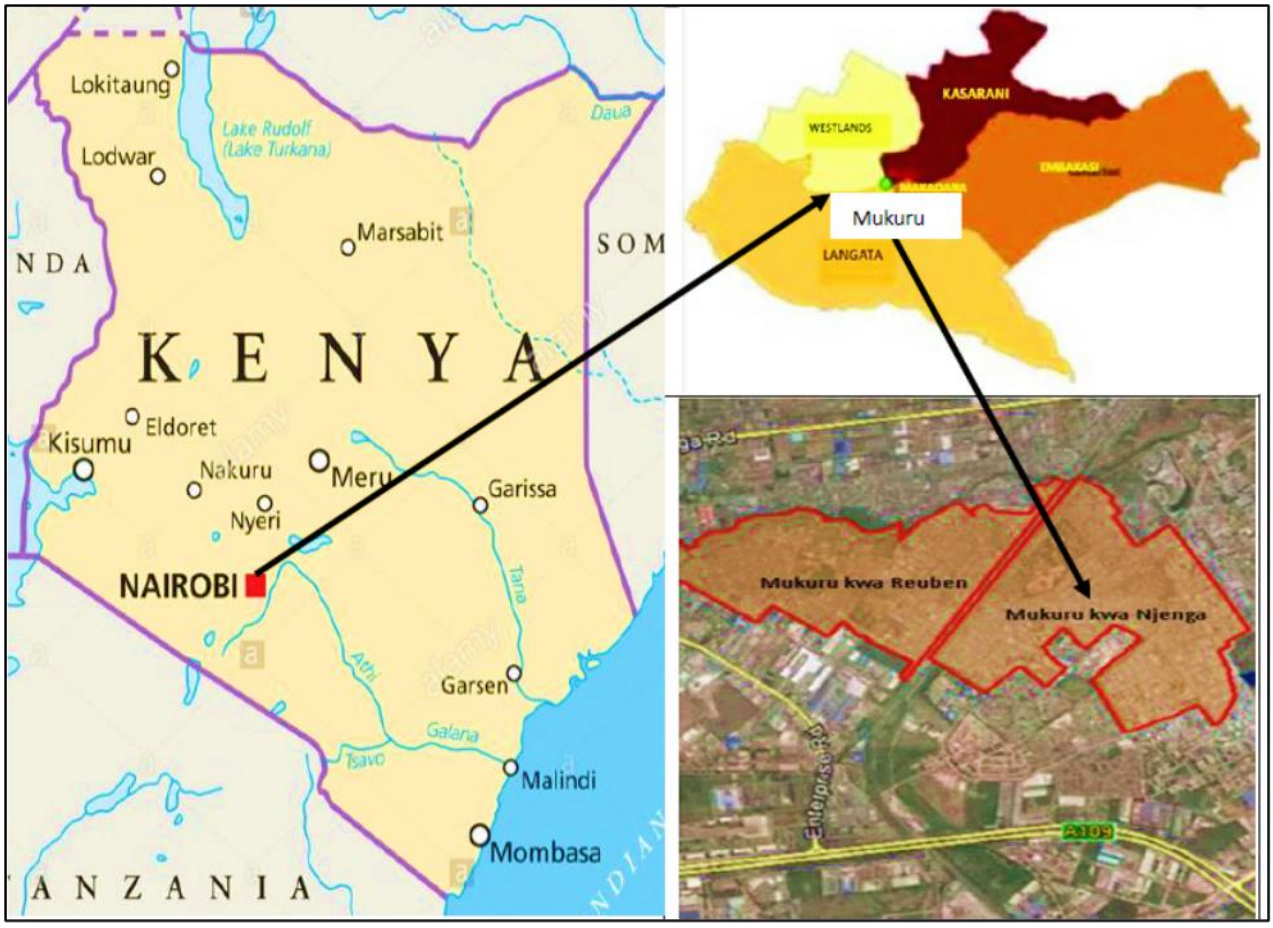

Figure 3.1: Location of Mukuru settlement in Kenya. (Source: Alamy, 2020)

Study site- Kya Sands

Kya Sands is situated 36km north-west of the CBD in the city of Johannesburg in Gauteng province (see Figure 3.2). It is neighbored by Kya Sands Industrial Area; to the south by an old landfill site and Hoogland Industrial Area; to the south east across Agnes Road by Bloubosrand a middle-income suburb; to the north by Msawawa informal settlement (Olumuyiwa, 2016). By 2009, Kya Sands had developed to be the largest informal settlement north west of Johannesburg with an estimated population of 16,238 people and approximately 3,000 households (ibid.). It covers an area of 38.5 acres (15.6 ha) with a population density of 2566/acre. This falls within the range of densities for informal settlements in the global South (Olumuyiwa, 2016; Weakley, 2013). Given its strategic location (closeness to light industries) of the settlement attracts many mineworkers and blue-collar workers in the nearby industries (Weakley, 2013). Section 6.2 presents more detailed contextual information about the settlement.

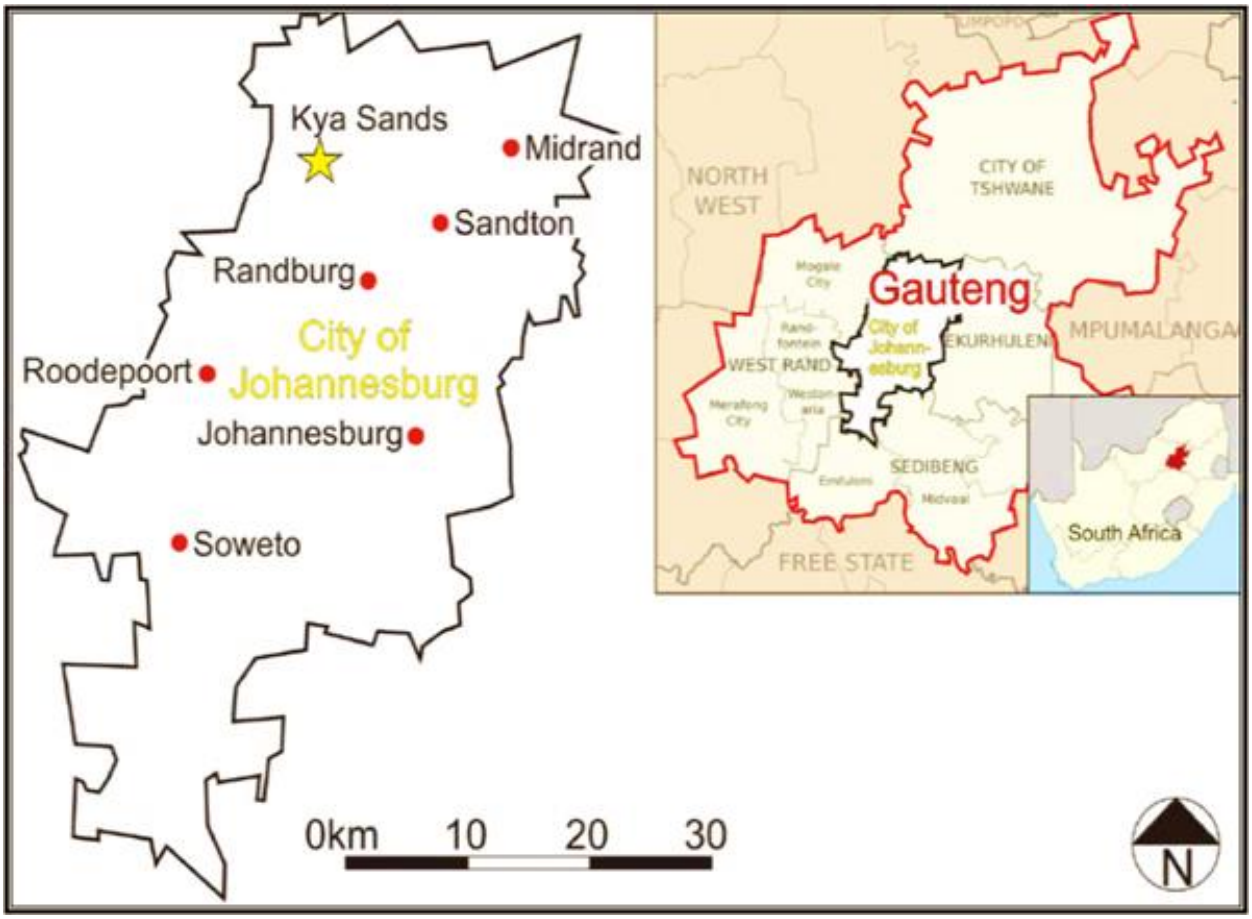

Figure 3.2: Location of Kya Sands and the surrounding areas (Source: Weakley, 2014:102)

3.2.2.1 Criteria for choosing the two case studies

Burgess (1984) argues that the choice of the case study site entails a complex process and the researcher should exercise caution in deciding the study area of the research. He further gives the criteria for choosing the site:

> "……. simplicity; (…..) allows researchers to move from studying simple situations to those which are more complex. Secondly, (…..) the degree of access and entry that is given the researcher. Thirdly, unobtrusiveness; (…..) the researcher to take an unobtrusive role" (Burgess 1984:61).

In deciding on the site for the study, I carried out reconnaissance surveys to determine the feasibility and suitability of carrying out empirical work in these contexts. The initial site visits and scoping exercise convinced me that the research questions could be adequately answered using data from both contexts. In addition, both sites had numerous secondary data sources which were easily accessible and networks that would facilitate access during my fieldwork. The choice of the sites was also motivated by their history, context as well as convenience of access for fieldwork, especially because repeat-visits were necessary for the successful completion of primary data collection.

The lack of piped water to residents' houses in both settlements was a simple and observable fact that allowed the interrogation of the factors that led to this situation. Besides, protracted water services delivery protests by residents led to an enquiry into the reasons for inadequate provision of water services. Although the water services situation in both sites has attracted attention from the state and non-state actors, proposed long term interventions have not been implemented. Moreover, the fact that the site has few donor/state-led infrastructure interventions offers the possibility of unravelling new dimensions of informality in water provision and the investigation of the dynamics and complexities in service provision.

I relied on the services of fieldwork assistants to access and navigate both settlements. Busi (pseudonym) had been previously engaged in a different research project in Kya Sands under one of the research institutes at Wits in 2013. Together with Busi, I attended a community meeting *incognito* at the Vukusenzele Community Centre where issues about social grants and food parcels were discussed. Through this meeting I was exposed to the dynamics in the community for instance how members presented their grievances and how the community leaders addressed the matters raised by residents. In Mukuru, I relied on Joseph

(pseudonym), a local research guide who was well known in the community (he was actively involved in a community-based organization that dealt with water services) and often engaged with the residents to explain the research objectives and requesting them for an interview appointment.

Equally, in Mukuru, the provision of water services is highly commercialized and dominated by water vendors as well as CBO in line with the neoliberal logic discussed in Chapter 2. On the other hand, residents of Kya Sands have a strong sense of entitlement of service provision by the government leading to a lack of willingness to pay for services (Huchzermeyer, 2008; Schnitzler, 2008). I found this distinction between the two sites important since theoretical reviews guided me to assume that levels of commercialization of basic services influence the variety and number of actors involved in access to water services. Even though I was aware that these criteria could have led to numerous alternative sites, access to the sites was the most compelling factor for choice as it made the sites feasible research options. The criteria for choice of the case studies are summarized in the Table 3.2.

Table 3.2: Criteria for selecting the case studies (Source: Author, 2018)

Case study	**Specific criteria**	**General criteria**
Mukuru	High levels of commercialization of basic services provision creating a culture of payment for services. Unlike other informal settlements in Nairobi, the site has limited government interventions in provision of basic services. Few donor/state led infrastructure interventions.	Availability of data about the area and the networks that would facilitate access for data collection. Hazardous physical environment. The history of the settlements. Protracted service delivery protests due to water shortage. Sites characterized by in situ upgrading and require special developmental attention by the government.
Kya Sands	Lack of clarity on the responsibility of service delivery. Strong rights and entitlement-based provision of services creating a culture of non-payment. Provision of free basic water.	

3.2.2.2 Why compare the two cases?

The study was based on the two cases of Mukuru in Nairobi, Kenya and Kya Sands in Johannesburg, South Africa Given the two case studies, the research strategy falls under the category of multiple case studies which allows for in-depth analyses based on viewing and substantiating the problem under investigation from different points of view thus augmenting the apprehension and interpretation of the issues as well as broadening the generalizations and transferability of findings from the case studies (Yin, 2009; Flyvbjerg, 2011).

In line with Omenya (2007), I consider the comparative approach a variant of case methodology rather than a distinct methodology such that the two cases gave me the possibility of direct replication of the study which allowed the comparison of the research findings from both cases. Such replication allows for uncovering new and contrasting themes and can either be literal in cases where similar outcomes are expected or theoretical where different outcomes are envisaged but for predictable reasons (Zach, 2006). Likewise, the multiple case study approach enabled me to conduct theoretical replication by focusing on comparison of the two different cases. In addition, the "analytic conclusions independently arising from two cases, (…) were more powerful than those coming from a single case alone" (Yin, 2009:61). This is because multiple case studies allow the researcher to conduct within-case analysis to familiarize with the data as well as to generate preliminary theories and cross-case pattern matching in order to examine the data through multiple lenses (Eisenhardt, 1989).

A comparison of the two sites was useful in building theoretical understanding and conceptualizations which must begin with unique and diverse urban experiences (Robinson, 2014). Comparative studies unearth existing similarities in social entities but also reveal their distinct attributes thereby sharpening a researcher's attention to detail or nuances which would be difficult to sense on the basis of a single case. Similarities call for application of general theory and processes across different environments premised on the idea that social patterns are ubiquitous and transcend boundaries of time and space while differences aim at showing the contextual variations and how these variations influence the specific outcomes of social processes (Mills et al., 2006). Moreover, comparisons allow for an understanding of activities, actions, processes and outcomes that are specific and unique to a particular context thus making the study more relevant to a wider audience as it extends and reshapes ideas in a way that one case study would not do (Rubin, 2013). Thinking across different cases can aid in more refined conceptualizations that allow the processes under investigation

to be better understood (Robinson, 2014). Specifically, comparative studies also constitute a response to calls by various authors such as Roy (2009) and Watson (2009) for theory-building from and across the global South. Moreover, McFarlane (2010) calls for comparison across differences to gain a nuanced understanding of certain phenomena.

The findings from a case study can be applied towards speculating, predicting, theorizing and hypothesizing (Eisenhardt, 1989). Comparison can guide more meaningful theorizations about water governance in informal settlements and thus provide a basis for inter-context learning. Rather than using global frameworks to explain local contexts and viewing the spaces located at the margin as exceptions this research looked at those locations as exceptions to the global frameworks (Ranganathan and Balazs, 2015). Moreover, comparisons have the potential to provoke debates across "diverse but highly interconnected urban experiences" (Robinson, 2014:58). While the two research contexts are quite distinct, the definition of cases should not be restricted to similar contexts because comparisons can be made of:

> "specific elements or processes in the cities or circulations and connections which shape cities thus rendering urban experiences comparable across much wider range of contexts and building research strategies which are adequate to the complex spatiality of urban form" (Robinson, 2014:57).

Whereas South Africa and Kenya differ in economic terms, political history and institutional structures, there are similarities between the two countries that may provide opportunities for scholars on cities for both countries. (Omenya, 2007). From an economic perspective, South Africa lies in 'middle-income countries' categorization. However, the country is also ranked as one of the most unequal countries of the world with the resultant problems of high levels of poverty, unemployment and crime. Additionally, the city of Johannesburg is at the heart of rapid and constant change while also being located in a country where state and party politics are highly intertwined (Benit, 2017). On the other hand, Kenya is ranked as a low middle-income country and is considered a significant player in the Eastern Africa region, with Nairobi well recognized as a major logistics and communications hub (World Bank, 2017). Besides, it is estimated that 25.6 of the urban population in South Africa lives in informal settlement while 60% of the population of Nairobi lives in informal settlements which occupy 6% of the city land (African Population and Health Research Center (APHRC, 2014; World Bank, 2021). Although devolution as a major theme of the Kenya 2010

Constitution has transformed economic and political governance and service delivery, the country still needs to address challenges of governance, inequality, poverty and unemployment. The study therefore deduced that both countries are faced with apparently similar developmental challenges even though their socio-economic indicators seem to be significantly different. Moreover, the health and fiscal responses to the recent Corona Virus Disease (Covid-19) resulted in economic shocks in both countries due to diversion of funds for urban economic development to combat the spread of the disease.

The right to water is enshrined both in the Kenyan and South African constitutions. The Free Basic Water (FBW) Policy was introduced by the South African government in 2000 as part of the Reconstruction and Development Programme (RDP) in order to address challenges of water access and historical injustices. The aim of FBW policy is to ensure that the poor are supplied with amounts of water that meet their basic requirements and recommends 25 litres per person per day which translates to six kiloliters per month for a household of eight people. Municipalities were mandated with the task of water provision and especially with regard to discretion of the service levels (Dugard, 2016). In addition, the South African Water Policy provides for a maximum of 200 metres walking distance from the dwelling to the tap. On the other hand, the Kenyan government subsidizes access to water services for poor households through the lifeline tariff for consumption of 0 to 6000 litres of water. The lifeline tariff is premised on the assumption that poor people have metered access to water hence making consumption easy to monitor and estimate. However, the majority of households in informal settlements do not have a metered connection. The difference in government intervention towards access to basic services made comparison between the two contexts a compelling approach.

Omenya (2007) states that undertaking a comparison based on political economy perspective can enhance an understanding of the extent which the phenomena under investigation is influenced by contextual differences. Such research examines the phenomena in a specific context towards an understanding of issues that are unique and can be attributed to a particular context and then across the contexts for issues that could be generalizable. Comparison was useful in critically examining various aspects thereby enhancing potential contribution of the study, especially towards improving the theoretical base for future studies. Likewise, Hantrais and Steen (1996) argue that cross national comparative research is useful in generating explanations for the commonalities and differences between contexts as well as deepening the understanding of how social processes crystalize which enable inter-context learning. Besides even if social

reality is context-specific, context itself becomes a key explanatory factor as well as an enabler (as opposed to a barrier) to national comparisons.

Equally, empirical evidence shows that comparative analysis facilitates a better understanding of the contextual differences of a phenomenon as cases are compared to assess "mainstream and marginal practices" of everyday practices in informal settlements that could be used to produce reasonably generalizable findings (Omenya, 2007: 39). As an example, Ranganathan and Balazs (2015) conducted a North-South comparison of water governance of two distinct urban areas in Tooleville, California State, USA and Bommanahalli in India. The comparison was useful for transnational learning of urban water politics and political agency. Within the African context, Omenya (2007) investigated self-help housing for low income groups in Johannesburg and Nairobi based on the motivation that similarities of the two contexts may present opportunities for sharing lesson across the contexts.

In conclusion, a cross case comparison of the two contexts provided a variety of urban experiences that can be used to build more diversified urban theory on how urban water is "politicized and contested" (Lawhon et al., 2014:498). Finally, the objective of cross case studies approach for this study was not to determine which of the two has better water governance practices and therefore give recommendations for improvement to the weaker. Rather, the approach arises from the expectation that a study of both sites deepens our understanding of the diverse dynamics of water governance across informal settlements within different national and urban contexts. Importantly, a greater understanding of the role of people-as-infrastructure is particularly critical today given Covid-19 pandemic which is still unfolding and the resultant global/national lockdown health protocols.

3.3 DATA COLLECTION METHODS

The study was a multi-method qualitative research where more than one data collection method and their associated analyses techniques were applied (Saunders et al., 2012). As a case study, it entailed an "empirical investigation of a particular contemporary phenomenon within its life context using multiple sources of evidence" (Robson, 2002:178). A mix of data collection methods was useful towards triangulation of the data gathered from different levels thereby giving both top-down and bottom-up perspectives of water governance in informal settlements. Moreover, the variety of methods enabled me to interrogate the varying assertions from different sources and the reasons why some aspects only emerged through certain data

collection methods (Harries et al., 2016). Employing several tools to gather evidence was useful towards developing the thread of inquiry and in gaining diverse viewpoints and insights into the topic as well as building strong arguments for the real situation (Olsen, 2004; Iacono et al., 2009).

Primary and secondary data were collected over an eleven-month period between August 2018 and July 2019. In line with recommendations from social science research, I initially planned the fieldwork to unfold along a systematic way only to realize that the process would be inevitably nebulous, intricate and convoluted and did not neatly fit into what is commonly prescribed. Throughout the field work I had to contend with the fact that in spite of the caution and care I took to remain objective in data collection with regard to sampling, the data collection process revealed itself to be inevitably political. Literature that claim to guide and interrogate research methodology, is largely silent on the politics of data collection within communities that are bedeviled and influenced by the everyday politics of access to resources such as informal settlements (Katsaura, 2013). Moreover, ethnographic research acknowledges that the perceptions and lived experiences of researchers inevitably influence their interpretation of the respective study findings (ibid.). This omission of "the politics of production and representation is often fueled by the push towards objectivity, neutrality and the researcher-researched distance in positivist, neo-positivist and traditional interpretative qualitative research" (Cunliffe and Alcadipani, 2016:2). As a specific example in this study, to accelerate the process of getting research authorization in JW and NWSC, I relied on my existing networks within the organizations to push the documentation through the bureaucracy.

In order to adequately respond to the research question, the study relied on complementary primary and secondary data collection methods to triangulate and corroborate data gathered thereby increasing confidence in the findings (Yin, 2009). This emerges from the understanding that the limitations of one data method is overcome by juxtaposing findings from the various data collection methods. The choice of certain data collection methods and the selection of respondents even though justified and rationalized, was equally political and subjective. In the next section I elaborate how each data collection method was deployed and the rationale for choice of the method. Table 3.3 presents a summary of number of respondents or iterations for the various data collection methods which include;

- Desktop survey
- Key informant interviews

Table 3.3:Summary of the number of respondents/iterations of the data collection methods (Author, 2020)

Data collection method	Number of respondents in Mukuru/ Nairobi	Number of respondents in Kya Sands /Johannesburg
Key informant interviews	19 (12 Male, 7 Female)	21 (11 Male, 10 Female)
In depth interviews: a) Residents b) Water vendors	 22 (7 Male, 15 Female) 12(10 Male, 2 Female)	 24 (8 Male, 16 Female)
Focus group discussions	2 (each with 7 residents) (4 Male, 10 Female)	1 (with 10 residents) (2 Male, 8 Female)
Transect walks	5 (total of 22 residents) (12 Male, 10 Female)	3 (total of 13 residents) (8 Male, 5 Female)

- In-depth interviews with households and water vendors
- Direct observation
- Focus group discussions
- Transect walks

Desktop survey

The research explored and engaged with print and electronic, published and unpublished, scholarly and non-scholarly materials as part of the literature review process focusing on previous studies and reporting which contributed to the theoretical and secondary data inputs for the study (Cooper and Schindler, 2014). The desktop survey also included textual and discursive analysis of government policy documents. The document review elicited the major actors and their practices in water services and the documented coping mechanisms used in the informal settlements. The insights were then used to shed light on the theoretical and empirical foundation as well as to enrich substantiation on the case study contexts, especially with regard to the normative mode of governance.

The desktop research enabled me to delve deeper into domains such as infrastructure, institutional and legal frameworks in both contexts, coproduction, everyday practices and coping mechanisms, informal

settlements, agency and governance at local (Mukuru and Kya Sands), national (Kenya and South Africa) and international scales (see discussions in Chapter 2). Thoughts and knowledge generated through documentary analyses were used towards fine-tuning the research question and related sub-questions. Additionally, between August and December 2018, there was heightened debate on water governance in Nairobi due to protracted water scarcity. During this period, I read 3 nation-wide newspapers per week to see how the story was being constructed, presented and read in the country by the media and to apprehend the direction in which the national public debate on water was taking and also sensing on who the dominant state and non-state actors in water services were.

Key informant interviews

In order to develop the case studies and to gain a better understanding of the two contexts, I conducted in-depth interviews with key informants who are knowledgeable about the topic and were willing to share their knowledge (Bernard, 2013). Key informants in a study "… provide the case study investigator with insights into a matter and also initiate access to corroboratory or contrary sources of evidence" (Yin, 2009:104). Key informant interviews were used to gather data on the conditions and challenges of water services and actors and their practices in water services in informal settlements.

These informants were drawn from state and non-state institutions and from the informal settlements as shown in Table 3.4. Purposive sampling was used to select the respondents. This non-random sampling method entailed the deliberate and intentional selection of participants who were knowledgeable or had experience about the phenomenon and were willing to share information about the phenomenon (Tongco, 2007). In Nairobi, key informants were drawn from the staff of the Water and Sanitation Department of the County Government of Nairobi (CGN), and from the Nairobi Water and Sewerage Company (NWSC). This was guided by their role in decision making and implementation of water policies. In Johannesburg, respondents were drawn from CoJ and Johannesburg Water (JW) particularly those involved in the planning of service delivery and provision of water services to informal settlements. In both contexts, experts in water research institutions as well as people affiliated to NGOs and other relevant organizations that work in the informal settlements were interviewed. In order to access information from JW and NWSC officials, I obtained permission from the Innovation and Technology Operations Support department and the Human Resources Department respectively (see Appendices 12 and 13). When applying for permission for access in JW and

Table 3.4: Distribution of key informants in the study sites (Author, 2020)

Type of key informant	Number of respondents in Nairobi	Number of respondents in Johannesburg
Religious leader	1	1
Non-governmental organizations, Community based organization / self-help groups	7	3
State officials	9	10
Community leaders	2	4
Water experts/consultants	0	3
TOTAL	**19**	**21**

NWSC, the Human Resources departments suggested the state officials who were best suited to provide the data I needed. Section 3.5 presents further details of how I gained access into both settlements.

Through the snow-balling sampling technique, I asked the initial respondents to recommend other informants whom I could approach for the subsequent interviews. According to (Bryman, 2012:439) "... certain informants (...) develop an appreciation of the research and direct the ethnographer to situations, events and people likely to be helpful to the progress of the investigation". Furthermore, Bjorkman (2010:30) elaborates that "…access – in both its infrastructural and methodological senses – is often cumulative, leading to ever-greater access". I was able to identify several respondents using this sampling technique and applied it till I reached saturation point whereby no new data emerged and the research sub-questions were adequately addressed. The duration of the interviews varied with most of them taking up to one hour, but five respondents in Mukuru and six respondents engaged with the interview over two hours. The interviews were held in venues that were convenient for the respondents (both in terms of access and privacy) such as offices or in public spaces. In both contexts, I found it necessary to have follow up interviews with some key informants to further probe issues they had raised in previous interview sessions or to deepen my understanding of the situation.

I utilized interview guides (see Appendix 3) to ensure that relevant information was captured while at the same time delving deeper into issues and corroborating the information that I had gathered earlier. All the interviews conducted in Johannesburg were recorded on an audio recorder after seeking permission from

each interviewee. However, the majority of the respondents in Nairobi withheld their permission for the interview to be recorded while in other instances I turned off the recorder when I observed uneasiness in the respondents due to the sensitivity of the information about the water situation in Mukuru. I reassured them that their identity would remain anonymous and pseudonyms would be used to cite them in the thesis. I summarized the responses in a notepad and filled in details after the interview. See Appendices 3a and 3b for excerpts of key informant interviews in Johannesburg and Nairobi respectively.

In-depth interviews with residents and water vendors

In-depth interviews were apt at collecting data on feelings and attitudes thereby making explicit things that might have remained hidden and implicit (Gray, 2009). In each research site, tailor made semi structured interviews were employed to explore the experiences of households and water vendors on the situation of water services (see Appendices 3a and b and Appendix 3c for excerpts of in-depth interviews in with residents and water vendors respectively). Also, Appendix 1 provides a summary of the socioeconomic characteristics of the respondents on both case studies. Moreover, in-depth interviews gave identified households the opportunity to reflect on the everyday practices and negotiations in dealing with inadequate water services. Interview guides with both open-ended and closed-ended questions were used to direct the interviews. The open-ended questions allowed the researcher to probe for details while the closed-ended questions facilitated for the more exact required for the study.

In Kya Sands, the choice of in-depth interviews was also informed by an understanding that black South Africans have a deep and prolific history of oral testimony (Furniss and Gunner, 1995). Being a typical low-income informal settlement in South Africa, the settlement is predominantly inhabited by "black" residents but of multiple ethnicities. Twenty-four interviews with purposely selected residents were carried out. In Mukuru, I conducted twenty-two interviews with resident respondents and twelve interviews with water vendors (see Table 3.4). In both contexts some open-ended questions emerged from the interview process. Interviews with residents from both sites were conducted in their homes, on the streets or at water points. On average each interview took about thirty minutes to complete. In both sites the interviews were conducted on weekdays and on weekends depending on the availability of the targeted respondents. For example, in order to secure interviews with single male respondents, the interviews were scheduled on weekends and public holidays when they were not at work. Equally, given the crucial role played by women in procurement, use and disposal of water, attention was given to letting the women speak in the absence of men.

Multistage and purposive sampling techniques were employed in the selection of respondents for the interviews in informal settlements. Multistage sampling entails combination of two or more non-probability sampling and is convenient when respondents are dispersed over a vast geographical area (Cooper and Schindler, 2014). Mukuru settlement has three sections; Mukuru kwa Njenga, Mukuru kwa Reuben and Viwandani (see Figure 3.1). Mukuru kwa Njenga was selected on the basis of being the segment with the highest number of donor interventions in water services in the settlement as well as for its convenience of physical access in the rest of the settlement. This section is further divided into eight zones namely; Zone 48, Milimani, Moto Moto, Riara, Wape Wape, Vietnam, AA and Sisal (see Figure 4.3). Kya Sands on the other hand is divided into sections A to E (see Figure 6.2). Purposive sampling was then used in both settlements to get respondents from each of the prioritized zones or sections. The adult head of a household was approached and invited to take part in the interviews (see Appendix 1 for a breakdown of the socio-economic characteristics of the respondents).

Interviews and the FGDs in Mukuru were conducted in English and Kiswahili as the two languages in which the respondents and I were conversant. In Kya Sands, some respondents had difficulty communicating in English and hence some the interviews were conducted in IsiZulu and SePedi with the facilitation of my fieldwork assistant, Busi. The assistant posed the question in the local languages and translated the responses to English for me in case I wanted to probe further. However, the FGD was conducted in English as the participants were comfortable expressing themselves in English.

Direct observation

Direct observation is "particularly appropriate if the purpose of the case study is to capture and portray the liveliness and situatedness of behaviors and to convey 'a sense of being there'" (Rule and John, 2011:11). Equally, there are silent and unarticulated social relations such a facial expressions or body postures that can only be captured through observation. Some behavioral and environmental conditions such as the improvised practices and maintenance of infrastructure can most effectively be directly observed in the course of data collection thereby adding new perspectives to water governance in informal settlements. For example, on one occasion in Kya Sands, I observed some children playing with water from a hose pipe connected to a standpipe (see Figure 3.3). I was puzzled because none of the adults who passed by stopped them from engaging in the activity. Given my experience in Mukuru where the water situation is dire, such a scene would have provoked an immediate reaction from any resident witnessing it.



Figure 3.3: A child playing with water at a standpipe in Kya Sands

Besides, direct observation enabled me to identify contradictions between what the residents said in the interviews and what I was witnessing. For instance, on a few occasions I observed residents in Kya Sands doing laundry at the water stand contrary to what they stated at the interviews that washing at the water stand was forbidden. Following the observation, I posed questions to residents and state officials to interrogate a specific phenomenon so as to understand it better. Chapter 7 presents more details on the practices.

Likewise, I observed that the residents would either dispose large quantities of wastewater accumulated into a bucket in a trench or sprinkle small quantities of wastewater on the streets and alleyways (see Figure 6.19). Whenever possible I took photographs of what I observed after obtaining permission from the residents. I also attended community meetings in Mukuru where various issues were discussed and possible solutions suggested. The invitation to attend certain meetings was extended by the community leaders or Slum Dwellers International (SDI) who thought that the meetings were vital for the study. I observed how the

residents expressed their concerns about the water situation as well as the interactions between the SDI staff, community leaders and the residents.

Focus Group Discussions (FGD)

In order to augment data collected through interviews, I conducted Focus Group Discussions (FGDs) because "complex activities that make up 'institutional interactions' cannot be captured by individual interviews alone" (Denzin and Lincoln, 2011:535). Further FGD can generate insights and surprises as the participants interact in a free and safe environment. For example, the FGD in Kya Sands revealed that people disposed of wastewater indiscriminately at night for security reasons and under the assumption of invisibility since "nobody would see them". However, during the day they did not engage in these practices.

Participants were selected and recruited based on predetermined criteria of ethnicity, social economic factors and a minimum length of stay of five years in their respective informal settlement. The criteria were developed so as to have homogeneous groups to facilitate easy and free conversations and ensure that no one feels inhibited to express his opinion during the discussions. Moreover, the minimum length of stay in the settlement was important in discussing how the water situation had evolved in the respective settlement. In Mukuru, two 75-minute FGDs (each with 7 residents) took place in a church hall on 29th August 2018 and 20th October 2018. In addition to identifying the discussants for the FGD, my research assistant planned for the venue of the activity. The dialogues were conducted in Kiswahili. The FGD in Kya Sands had 10 residents who were recruited through Vukusenzele community centre where my guide Gugu worked as a community volunteer (see Table 3.4).

Additional criteria for FGD-participants included knowledge about water services, their role in the community as well as their length of stay in the settlement. As such, selection for participation in the FGD was purposive and based on non-random sampling. With Gugu's assistance, I selected the discussants based on the pre-established criteria and he invited them to the forum. The FGD was held at the community centre and executed in English for 90 minutes. The venue was deemed convenient due to its location and accessibility. I moderated the discussions and ensured that all the discussants had an opportunity to give their opinions freely and that the research objectives were met. Appendices 1 and 1a respectively contain the process and the schedule for the FGD. Appendices 2 and 2a contain the protocol and schedule utilized for the process

while Appendices 2b, 2c and 2d summarize contributions from the two FGDs in Mukuru and the one in Kya Sands.

Transect Walks

Transect walks (also referred to as walking interviews) are useful for generating embodied local knowledge of the research context which leads to marking out significant questions and processes (Pierce and Lawhon, 2015). Besides, transect walks allow both the researcher and the participants to gain spatial experience of the research sites which enhances local literacy with regard to how practices are linked to spaces (ibid.). The choice of the transect walk was motivated by the fact that environmental factors influence the dynamics of the interview discussions hence the method was useful in connecting people's responses to spatial location within which they said it (Evans and Jones, 2011). The walks provided a situated appreciation of the social and contextual factors at play with regard to water access, use and disposal.

Through the transect walks I gained insights on things that were not raised during the interviews with the residents and key informants. For instance, I would not have known the extent to which urban agriculture was practiced in Kya Sands and how water from the standpipe was diverted into the gardens and greenhouses located on the periphery of the settlement. After explaining my research interest to the volunteer residents, I asked them to determine the route for the walk. This was an icebreaker to make them comfortable and encourage their participation in designing the itinerary (ibid.). Equally, they enjoyed the responsibility of showing my research assistant and I around 'their' settlement and explaining how things have evolved around the standpipes and chambers in Kya Sands and Mukuru respectively. Besides, I found it easier to tap into the residents' understanding of the place during the walks given that the residents brought to my attention issues that they thought would be relevant to the research.

I took three walks with volunteer residents and the chairman of the settlement committee in Kya Sands. One walk was taken in the rainy season and the other two in the dry season. Five walks were taken in Mukuru, two in the rainy season and three during the dry season (see Table 3.4). The walks were undertaken in different seasons because weather conditions influence the nature and intensity of negotiations for water services (Velzeboer et al., 2017). For example, in the dry season, the interactions around water are likely to be under more pressure due to limited alternative water sources. While walking, I talked to the residents accompanying me and took note of any striking issues that may not have been picked up from the interviews.


Pentagon Rd
Verdun Rd
Hilston Rd
Van Diemen Rd
Bay Pl
Bay Cl
Bay Pl
Bay Pl
Bay P

walk and water diversions from the tap. Upon noticing diversions, I investigated where the water was diverted to and if the necessary permits had been obtained for the diversions. Finally, during the preparation for the transect walks, I was cognizant of the fact that certain respondents were excluded from the walks for various reasons. For example, in both research sites the two pioneer women of the settlement could not accompany us for the walk because of age and health status.

3.4 RESEARCH METHOD BY SUB-QUESTIONS AND THEIR RELATED DATA COLLECTION TOOLS

The data collection methods discussed above were used for the case study design. Table 3.5 shows how these methods were used to gather data that were applied towards answering the sub-questions of the study. The table shows the research questions, the data required for each research sub-question, the sources of data, the data collection methods that employed and where the data are consolidated and analysed. The table therefore shows how the sub-questions were operationalized through data collection and analyses.

Table 3.5: Links between the research sub-questions and the overall research strategy

Research sub-question	Data required	Source of the data	Data analyses	Where consolidated and analysed
1. What are the conditions and key challenges of water access, use and disposal in informal settlements?	The current situation of and challenges in water access, use and disposal. The status quo of the different components of infrastructure (material, people-social relations and the human body- and knowledge).	Residents; Direct observation; Key Informants: state officials, religious leaders, CBO/SHG/NGO leaders, community leaders, water experts; Water vendors; Documentary analyses FGDs Photographs	Analysed track logs from transect walks; analysed photographs taken during the walks. Transcribed interviews or data weekly after the interview/fieldwork. Observe, reflect and cluster similar patterns from the data using *Atlas ti*.	Chapter 4 and 6 for Mukuru and Kya Sands respectively.
2. Who are the key actors and what are their roles in water services in informal settlements?	Identify the state and non-state actors, their networks and associations in water services; the roles of the different actors;	State and non-state key Informants: state officials, religious leaders, CBO/SHG/NGO leaders, community leaders, water experts; Residents; Water vendors; Borehole owners; Documentary analyses FGDs	I transcribed interviews and data a few days after the interview/fieldwork. Used *Atlas ti* to look for themes within the text and their frequencies in the text. The significance of the themes was determined by their salience. Visual representations of the relationships and of the actors (see Figures 5.11 and 7.25). Production of maps and networks.	Chapter 5 and 7 for Mukuru and Kya Sands respectively.

3. How do actors in informal settlements negotiate and secure water access? What are the inter and intra-household dynamics regarding water access in informal settlements?	Coping mechanisms employed by various actors for inadequate water services; Practices for gaining, maintaining and denying water access.	Residents; Water vendors; Direct observation; Key informants: state officials, religious leaders, CBO/SHG/NGO leaders, community leaders, water experts; Documentary analyses FGDs	Analysed photographs taken during the transect walks. The comments from the FGD were uploaded onto *Atlas ti* programmes. The themes arising from the discussions were then analysed and synthesised.	Chapter 5 and 7 for Mukuru and Kya Sands respectively.

3.5 THE POLITICS OF ACCESS

Gaining access to the research sites is a prerequisite for the research being conducted hence it determines the quality, reliability and validity of empirical findings (Burgess, 1984). Securing access is not a one-off step at the beginning of the study but is a process that involves multiple steps that pervade the whole research process (Burgess, 1984 and Flick, 2007). Bryman (2012) suggests that a critical and yet difficult step in research is negotiating access into the study site pertinent to the research questions, this proved true in my work. Throughout the research, I had to (re)create and maintain relationships so as to advance to the next level of my data collection since access is a deliberate (though it may be emergent), non-linear and political process (Cunliffe and Alcadipani, 2016). Therefore, access in this study involved (re)negotiation with various parties in the different research sites. I was also aware that access was more than mere physical presence and included earning people's trust so that they could share their deep insights, experiences and knowledge with me (Flick, 2007; Denscombe, 2010).

Community leaders were crucial gatekeepers in negotiating my entry because they granted me permission to access people and events in the sites and provided validation for me as a bonafide researcher as well as facilitated access to people who were not initially part of the study (Denscombe, 2010). Community leaders play a mediating role between their communities and external parties through legitimation at the bottom by seeking consent from their constituents to act on their behalf (Benit- Gbaffou and Katsaura, 2014). I got the contact of a community leader in Kya Sands who was previously involved in the Wits City project from an administrator at the University of the Witwatersrand (as discussed in section 3.2.2.1). On the day of the meeting, he came 2 hours late accompanied by another community leader and a member of the settlement committee. After introducing myself and my research assistant, I explained the research objectives and the data I needed to collect to achieve my study objectives.

I was granted permission to collect data in the settlement on condition that I would engage a local guide and pay a predetermined daily stipend. We agreed on the stipend at the end of the meeting. Moreover, the community leaders requested a copy of the findings of the research project report saying; "we are interested in the findings of the research so that we can back our complaints to JW with facts" (Personal communication, community leader 5, 11-11-2018). I explained that the findings of the research would be available to the public on the University's website upon graduation. At the end of the meeting, the other community leader said that he would look for a guide who was conversant with the settlement. After a week, he introduced me

to Gugu (pseudonym) my local guide who proved to be useful for the fieldwork in a number of ways. Firstly, he provided advice on security issues to my research assistant and myself by indicating the "high risk" streets and walkways. Secondly, the fact of being introduced by a fellow community member generated trust which created an easy rapport with the residents.

The fieldwork deepened my understanding of research as opportunistic especially in conducting in-depth interviews and the transect walks as these depended on the pre-existing relationships that my guide and the people leading transect walks had with the participants. Most importantly, waiting to gain access to the community through the community leaders taught me about the hierarchy, processes and practices of the community even before engaging the residents. I learnt that there are structures which serve to distinguish insiders from outsiders as a way of protecting the community's way of life even in sites that seem chaotic due to the disorganized appearance on the surface. Hence, the process of gaining access into the settlement was a form of 'initiation' as a researcher as it gave me insights into how governance in informal settlements works.

Moreover, the "Reshaping socio-ecological landscapes through collaborative practices", (a transdisciplinary upgrading project of Kya Sands in 2013 by the City Institute of the University of the Witwatersrand -Wits) facilitated my access into Kya Sands. When I introduced myself to the community leaders, they spoke about the project and the remuneration they received. Taking advantage of the conversation, I explained that the research was different as it was not donor funded and therefore, they would not enjoy the same perks as in the previous project. After a lengthy negotiation process, they agreed to facilitate the process without payment. On the other hand, the situation in Mukuru was different since in spite of explaining that the research would not entail remuneration, the residents and water vendors expected and sometimes demanded payment. They argued that the time spent answering the interview questions and participating in FGDs meant that they had to temporarily close their businesses to attend the interviews or FGDs. Besides, they argued that a token of appreciation had been given in previous research engagements dealing with water so they wondered why my study was different. Apart from the fact that their arguments made sense, I also realized that I was not going to make progress in the fieldwork without rethinking my position. After consulting with my research assistant and researchers who had conducted research there previously, I decided to give supermarket vouchers of Kshs.200 (equivalent of 2 USD) per participant in interviews and FGDs. Further discussions on the matter are found in Section 3.9 on ethical considerations.

In August 2018, I was invited to a three-day multi stakeholder workshop organized by the County Government of Nairobi (CGN) to discuss the progress of the SPA agenda for Mukuru. This workshop was an important launch pad for gaining access given the diversity of stakeholders and my initial interactions with them at the workshop which enabled me secure interview appointments. Besides, pilot studies in both sites gave a clear indication of the research objectives and the implications for the participants as well as assessing the adequacy of the research instruments in addressing the research question. (Burgess, 1984). Likewise, the pilot study provided an opportunity for subsequent reconnaissance analyses of the study settings.

Access to state officials in both contexts required formal permission from their respective institutions. Although the processes were straight forward in theory, a lot of back and forth correspondence ensued and as a result, the lead times for obtaining the permission letters were approximately two months and six months for NWSC and JW respectively. This 'waiting for the state' to grant access made me realize that I was doing research on the terms of the state as opposed to mine (Oldfield and Greyling, 2015:1100). This experience forced me to reflect/re-think on my role as a researcher purely as a neutral knowledge-driven initiative. Besides, interactions involved in the waiting also offered me an opportunity to learn about the operations of both utilities particularly the role of certain gatekeepers in the organizations. Once permission was granted, officials were eager to share information about water services in the informal settlements and the city at large.

3.6 LIMITATIONS OF DATA

Upon reflection after the fieldwork, I identified the challenges that I encountered which are discussed under three major headings;

i. Translation and transcription
ii. Absent voices
iii. Timing of the interviews

Translation and transcription

My research assistant in Kya Sands simultaneously translated the interview responses which worked out well because the alternative would have been to translate every response that the participants gave at the end of the question but this would have prolonged the interview duration as well as interrupted the train of thought of the interviewees. The recorded interview responses were translated and transcribed by Busi who was present at the interviews and was privy to the discussions and understood the context of the interview well.

Given that real time translations were constrained, probing and posing follow-up questions were limited. Based on the interviews of a particular day, I had discussions with Busi at the end of each day or on the morning after the interview to assess if there was need to follow up some issues with participant(s) who had been interviewed that or previously. Equally, I lost some nuances since the interviews were not conducted in English. For example, during an interview one of the participants suddenly began crying and I thought that my research assistant had upset her, but he explained that she was moved by the memory of how dire the water situation was when water tankers from JW were the main source of water in the settlement. Moreover, since I could not replay the voice recordings, I was not able to capture the unarticulated or the unspoken cues from variations in voice tone or pitch as I relied solely on the written transcripts.

Absent voices

Given that the intra-household dynamics on access, use and disposal of water services are multifaceted, it would have been beneficial to conduct the interviews when most family members were present in the house to deepen the understanding. This was not possible in both research sites. For example, in Kya Sands, the majority of male residents were out at work and the children in school during the interviews. To deal with this challenge I decided to conduct some of the interviews during the weekends and on public holidays when more household members and male interviewees were available. This provided an opportunity to hear the narrative of the water situation from the perspective of male residents. As highlighted previously, in Mukuru, there were people who declined the invitation to be interviewed out of fear. Further discussions on this are presented in Chapters 4 and 5.

Timing of the interviews

My research guides Gugu and Joseph cautioned me that weekends and public holidays were not suitable for conducting interviews because of increased violence provoked by prevalent drunkenness among the residents in both research sites. Interviews during the weekend were only scheduled in the morning and would end by midday. Moreover, data collection in these contexts called for flexibility in dealing with unforeseen events such as changes in the timing of the participant's schedule as well as cancellations.

3.7 DATA ANALYSES

Data analyses were undertaken through sorting, editing and coding data for meaning-making of the data in relation to the overall research question and the sub-questions. The study employed case study approach

with qualitative data analysis as the main analytical approach. Data collection and analyses were conducted simultaneously in line with Burgess (1982: 236) who notes that;

> "… the research process involved constant analysis as field notes were read and reread to discover relevant problems of the study (…). Analysis continued throughout the study and provided an outline for many of the conclusions contained in the final research report".

I kept a research diary, took notes, wrote memos and used audio recorders to record interviews (see Appendix 4 for excerpts of the field diary). The audio recordings were transcribed and cross referenced to the field notes. Overall, data were analyzed in a manner that allowed for a holistic description of the history of the cases, chronology of the events and day to day activities of the case.

The unit of analysis is "the level of aggregation of the data collected during the subsequent data analysis phase" (Sekaran and Bougie, 2013:104). It is the primary unit of measurement or analysis in a particular study. Units of analyses may include individuals, organizations, organizational documents, geographical units and social interactions (Bryman and Bell, 2015 and Yin, 2009). The units of analyses for this study was the "point-of-access" in both settlements. The "point-of-access" is a spatial-temporal phenomenon rather than purely spatial one. On the temporal dimension, it entails the interval between moment-of-need/demand till moment-of-procurement at household level which also applies to the waste-water disposal as well. The spatial dimension is the "local-geography" traversed primarily by people-as-infrastructure in order to bridge across the temporal moment-of-need with the moment of procurement at household level. Thus, the point-of-access includes state and non-state actors such as the households, the state and the water utilities as well as their practices in the two research contexts. These units of analyses provided the data required for building a comprehensive view of the selected cases.

With regard to data collected through interviews, transect walks and FGD, data analyses were iterative, continuous and pervaded the whole research process (Denscombe, 2010). I engaged my research assistant and my guides after every interview to discuss the new finding(s) or essence of the just concluded interview and to compare that interview with other interviews that we had on the same or on a different day (preliminary analysis within and across interviews). I found this approach useful as it enabled me to decide if more interviews were required either to corroborate what we had just heard or to elaborate further on some issues.

Thematic data analyses was employed and it entailed "identifying, analyzing and reporting patterns (themes) with the data" (Friese, Soratto and Pires, 2018:8). Themes capture important data that address the research objectives and other issues in the research as discussed in detail in Chapters 4, 5, 6 and 7. A dual process of thematic data analyses comprised of initial data coding aided by *Atlas ti* (computer assisted qualitative data analysis software - CAQDAS) which was useful in storing interview transcripts, field notes and the research diary. This was coupled with manual data coding matrices in line with key themes emerging from *Atlas ti* coding. The choice of using *Atlas.ti* was motivated by the fact that the software can be used with other theoretical approaches and several data analysis processes (Soratto, Pires and Friese, 2020). Figure 3.5 is a flow chart diagram showing the coupling of manual versus the automated data analyses for the study. This is elaborated further in Table 3.6.

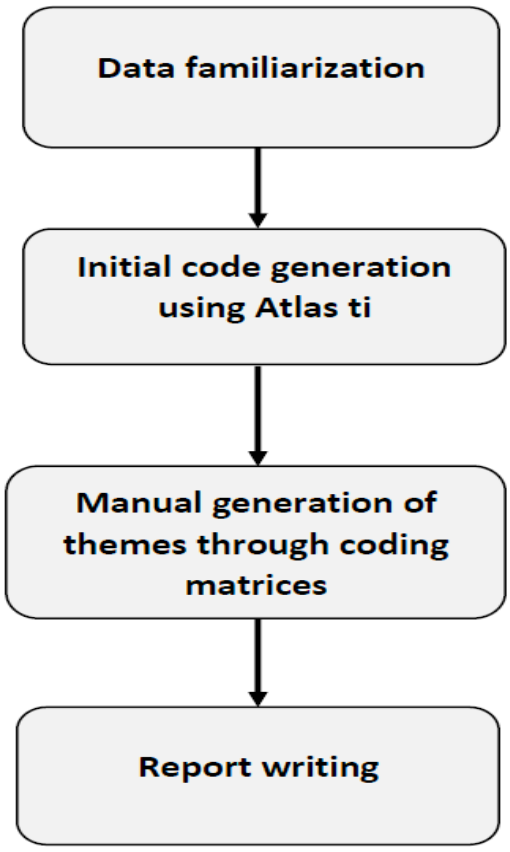

Figure 3.5: Flow chart diagram of data analyses for the study (Author, 2020)

Table 3.6: Thematic analysis using Atlas ti and manual data coding matrices (Source: Author, 2021

Stage of analysis	Activities
1. Data familiarization	❖ Begins at the data collection and transcription stage. ❖ Project creation on *Atlas ti.* ❖ Uploading and grouping documents on *Atlas ti.* ❖ Re-articulation of the research objectives. ❖ In depth reading of the documents and the field notes. ❖ Read and re-read the documents severally.
2. Initial code generation	❖ Generation of a code list on *Atlas ti.* ❖ Reading the documents and assigning existing or new codes. ❖ Writing comments of possible meanings and interpretation of the codes.
3. Searching for themes through manual matrix coding	❖ Check on the meaningfulness and validity of data for the sub-questions. ❖ Manually labeling, capturing and abstracting the content(s) for analyses. ❖ Using the traffic light model to colour code the conditions for access to water services. ❖ Relating and grouping the themes across the densities of impeding versus enhancing data to tell a compelling story about the research questions. ❖ Manually compiling results in tables, figures and diagrams.
4. Report writing	❖ Weaving the narrative together to adequately respond to the research question and supporting it with extracts from data. ❖ Prepare screen shots for the methodology section of the report.

In analyzing data, I first made sense of the data at hand and after receiving the transcribed data, I checked for the accuracy of the data by randomly replaying selected interviews while checking the transcribed data. With regard to transcriptions that required translations, I engaged the services of a transcriber proficient in IsiZulu and SePedi to countercheck the translations and transcriptions. The initial coding entailed a process whereby labels were assigned towards grouping of the different responses to the interview questions using *Atlas ti* software. After the initial data coding, the analyses were executed through manual matrix data coding. The initial coding was done at face value by focusing only on what the participants said and later attention was given to the possible meanings and interpretations of the data (ibid.). Through deductive analysis some of the codes were predefined based on elements from the conceptual framework while other codes were derived inductively by obtaining codes from the data themselves (Evans and John, 2011). A total of 665 codes were generated based on the data collected from both sites (see Appendices 9a, 9b, and 9c for coding outputs of *Atlas ti.*

The initial codes generated through *Atlas ti* were then manually classified into different labelled groups based on the research questions. The classification was done by checking if the sub-themes were co-related with governance in an impeding, neutral or enhancing manner for both Mukuru and Kya Sands. The coding used the traffic-light model where Red=Impeding, Orange=Neutral and Green=Enhancing condition in access to water services (see Table 4.1 and Table 6.1). After coding, data analyses in terms of 'what does this means for governance?' were conducted. This process entailed co-relating across the densities of impeding versus enhancing data and how these manifest in terms of the situation on the ground within each settlement.

Figure 3.6 presents a chart of the two core themes of the first sub-question on conditions and challenges. These two then branch out to several sub-themes illustrated in the chart and which formed the basis of the analyses. Figure 3.7 shows a chart with the core themes of the second and third sub-questions which branch into the sub-themes. The corresponding data coding matrices will be presented in chapters 4, 5, 6, and 7. The initial key sub-findings for Chapters 4, 5, 6, and 7 were aligned to the working hypothesis presented in Section 1.6.2. Figure 3.8 presents the approach taken in aligning the conceptual framework, the working hypothesis and the sub-questions in the remaining Chapters. Additional analyses were then undertaken to produce patterns and themes for analyses by identifying major issues within each case and the common themes that emerged from both cases (Yin, 2009).

Themes were generated through manual abstraction from raw data which entailed relying on quotations to connect the real and the conceptual in order to bring out the salient issues of the study. The prominent quotations in relation to the research question were selected for the report. Themes were also identified by closely scrutinizing and examining for moments when the discussion digressed into other issues that cannot be adequately explained by the guiding questions or the researcher's probing (Ryan and Bernard, 2003). For example, when I posed questions about the residents' participation in water governance in the settlement, the discussions shifted to the meaning of water in everyday life. This generated a theme that I had not anticipated previously. Cross case synthesis was then undertaken by using the conceptual framework to make comparison possible by identifying patterns such as commonalities and differences between the two sets of data. The emerging patterns were then identified. Finally, the photographs taken were later analysed to make sense of the people or activities that were captured in the image.

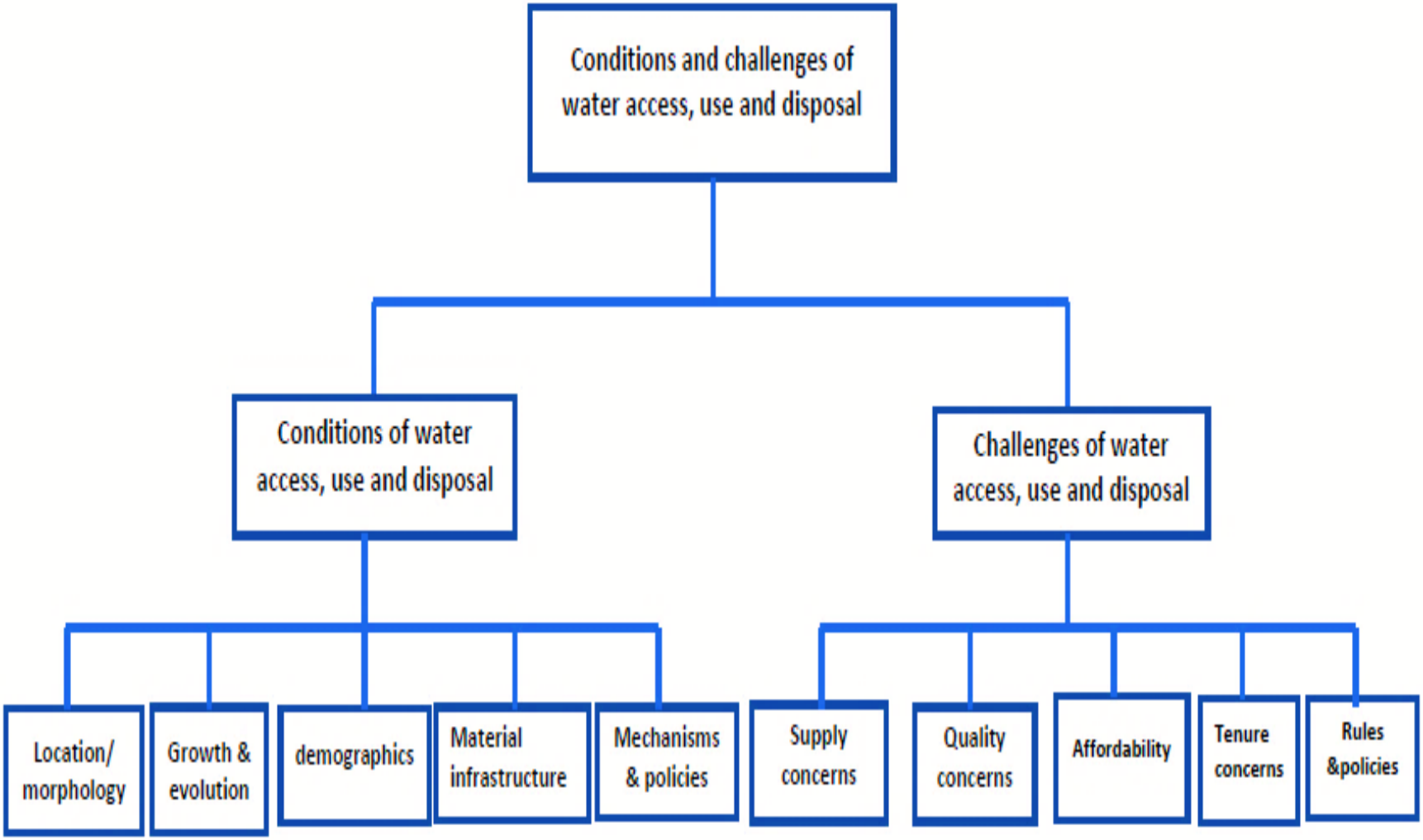

Figure 3.6: Key themes and sub-themes of sub-question 1 (Author, 2021)

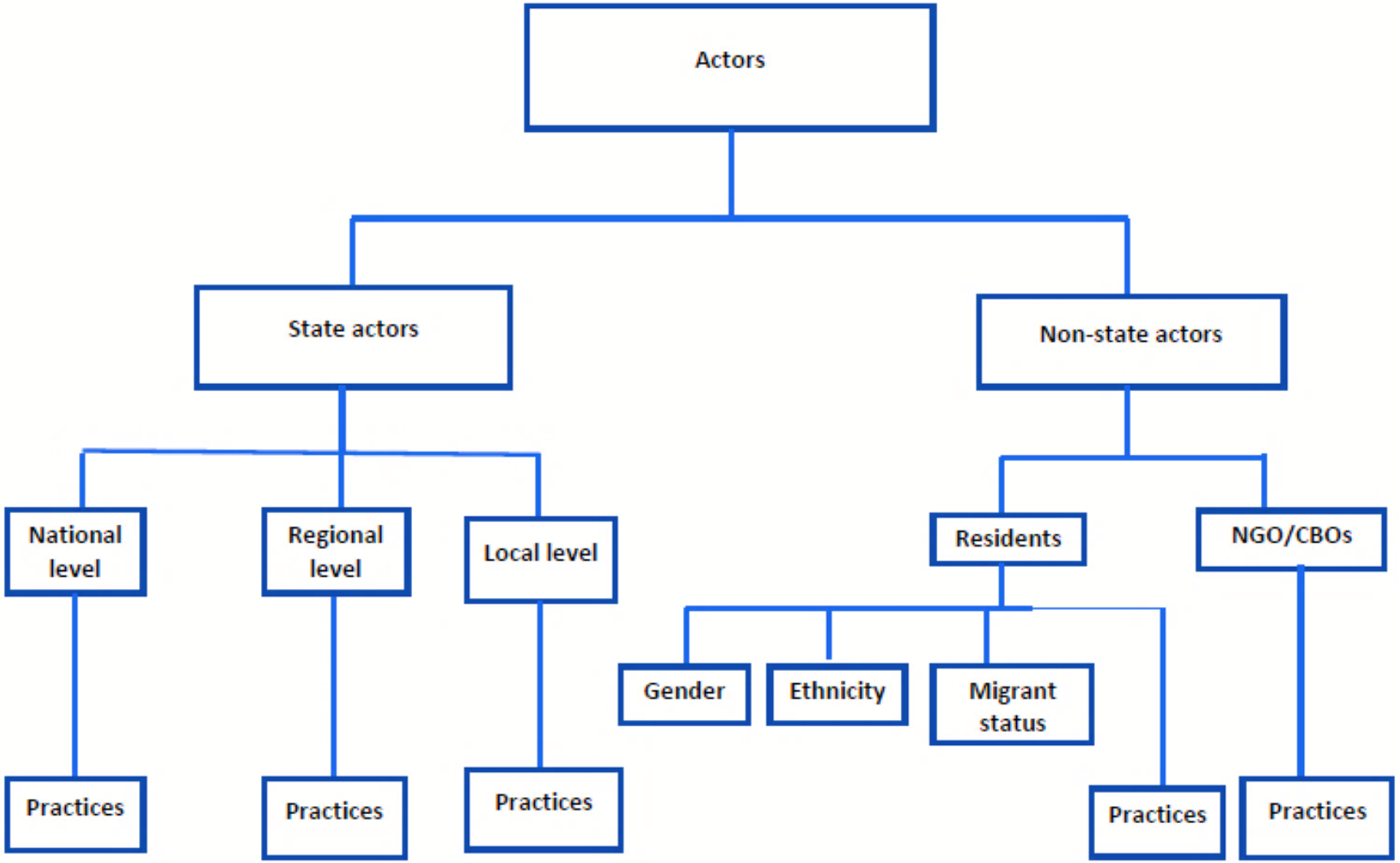

Figure 3.7: The themes and sub-themes of sub-questions 2 and 3 (Author, 2021)

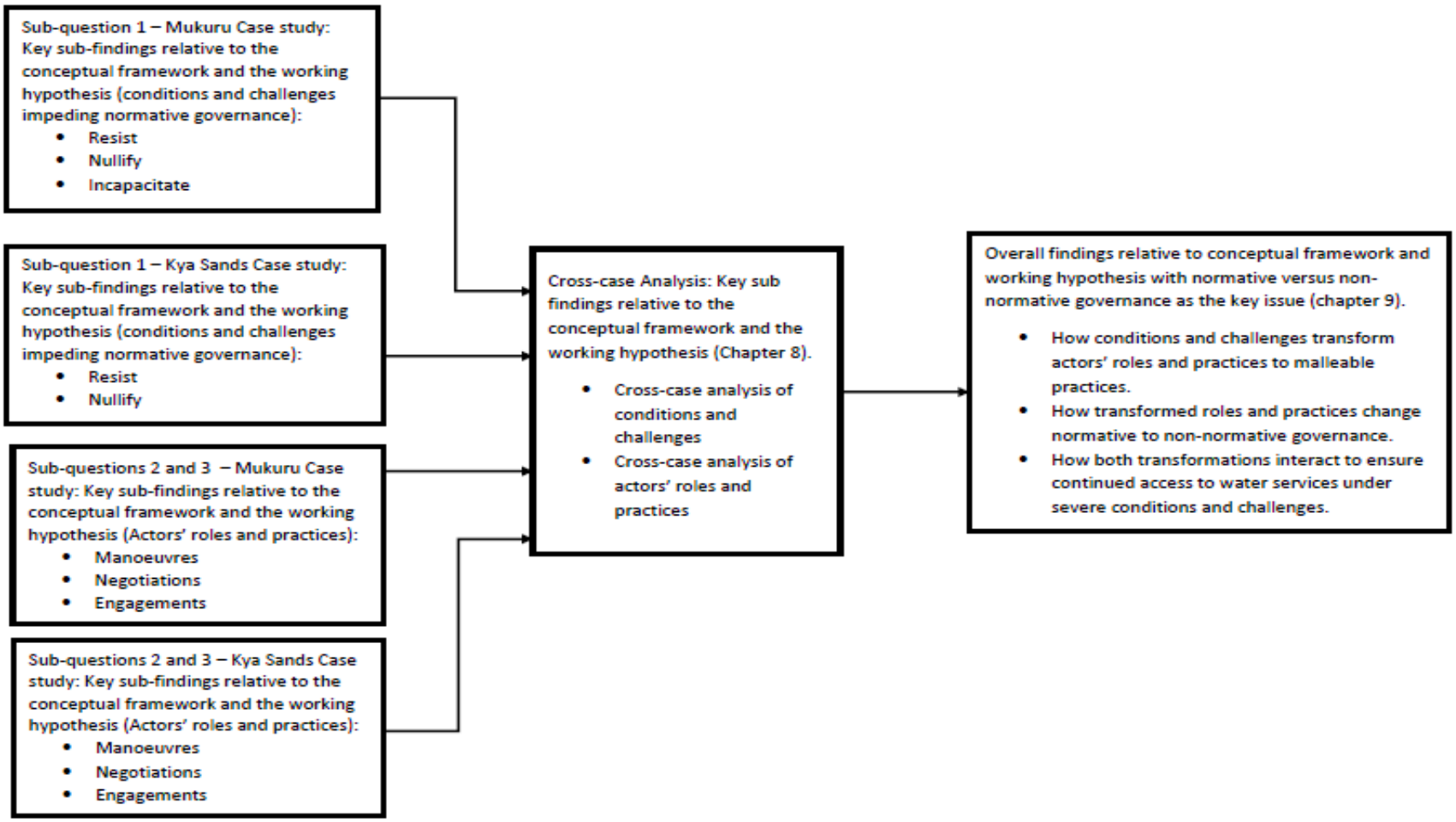

Figure 3.8: Aligning the conceptual framework, the working hypothesis and the sub-questions (Author, 2021)

3.8 POSITIONALITY

Given that a researcher's previous experience and knowledge influences on what is observed and how it is interpreted, research findings at the end of data collection would inevitably reflect the researcher's interpretation of the situation (Denscombe, 2011). In relation to the two case studies, the case study of Mukuru is based on a site where I was involved in a project for two years as a researcher. The research was conducted by a consortium of two universities and three NGOs funded by International Development Research Centre (IDRC). The objective of the research was to gather data that would be presented to the County Government to form the basis for declaring the area as a Special Planning Area (SPA). SPA is characterized by "unique development and environmental potential while also raising significant urban design and environmental challenges" (GoK, 2012). I was part of the finance team of Strathmore University (a private university in Kenya) that evaluated the livelihoods and the economy of the informal settlement. In order not to widen the socio-economic divide between myself and the respondents during the fieldwork for this study, I pushed forward my involvement in the SPA project and held back my association with the university. On the other hand, in Kya Sands I emphasized my connection with Wits due to the previous projects undertaken by the university in the area and the regard that the community leaders and the residents have for the university.

The situation analyses in Mukuru involved estimating the price penalty of basic services for the urban poor. The research revealed that water had the highest price penalty. For instance, families in informal settlements often pay more than 172% for water compared to those in formal precincts. Water and other services are supplied by cartels who charge exorbitant prices for the services and threaten residents with violent evictions and demolitions (since many of the members of the cartels are landlords in the settlement) leaving them with no alternative than to purchase from them. Even though I am not currently involved in the implementation of the plan, I left with a firm conviction of the "correct" way of approaching the water problems plaguing the residents of informal settlements. For me, the solution lay in the elimination of cartels or negotiation of price caps between the government and the cartels. Though my experience augmented my understanding of the problems in the area I was cautious not to intentionally or unintentionally make my findings to coincide with those of the research that I was involved in or my subjective biases on what I initially deemed to be the right solution. The good relationships established with various parties in the previous research provided an avenue for access to the research site while the knowledge of the setting acted as a basis for negotiating access (Burgess, 1984).

The other case study was based in Johannesburg. My position as a black non-South African female conducting research in a country where I had lived for less than two years, influenced how I conducted the study. I had to rely on the services of a guide for personal safety concerns as well as to reduce the uneasiness that my position as a researcher might have elicited in some of the interviewees. I recognized my vulnerability in both settlements, and especially in Kya Sands where I could not engage with the residents directly nor could I understand the conversations that were going on around me. I relied on my research assistant to stay informed about the discussions and happenings around me. On the other hand, the fact that there were instances in which I was not engaged in conversations granted me an opportunity to observe and reflect on my surroundings. Most importantly, this second case study was in a site I was less familiar with and addressed the distrust of my own certainties based on my experience in Nairobi. Furthermore, the comparative study was useful in testing the certainties I had built in the Nairobi case by taking a distance from these certainties. The comparison was helpful in unsettling my own positionality to test how differently I apprehended water issues and find my 'voice' by initially going out of my "comfort zone".

I organized my fieldwork in two stages. The first stage was in Nairobi while the second was in Johannesburg. Given that there has been no overt government intervention in service provision, the Mukuru situation is dire and calamitous. On the other hand, the government is involved in the provision of basic services in Kya Sands and therefore even though the water situation is inadequate, it is not as desperate as in Mukuru. I had to avoid cynicism (both outwardly and inwardly) at the responses of the residents of Kya Sands with regard to their experiences of water access given the relative ease they had in comparison to those in Mukuru. I had to be aware of how my positionality of having conducted the research work in Mukuru would affect my views of Kya Sands because of the;

> "relationships among perspective, power, and the ethnographic voice, and the way these relationships shape not only what is seen (a question of access), but also how it is seen a question of the production of ethnographic knowledge itself" (Pachirat, 2009: 144).

During the fieldwork I had to suspend my normative and critical judgements about state officials perceiving them as corrupt, incompetent and incapable of handling the changes needed in service delivery. This was necessitated by the need to gain a balanced view of the situation. In order to overcome my biases, I listened keenly to understand their point of view as opposed to trying to confirm my prejudices and suspicions based

on their narratives. Listening keenly made me empathetic and relate with their frustrations and the challenges in water services provision to informal settlements. Additionally, interactions with state officials who attended the stakeholder workshop on Mukuru settlement were useful in shedding off biases and preconceptions in order to start appreciating their efforts to improve water service provision in under extremely challenging conditions.

3.9 ETHICAL CONSIDERATIONS

The study adhered to the ethical guidelines issued by Human Research Ethics Committee at Wits for conducting research involving human subjects/participants (see Appendix 11). Given that the study engaged human subjects, ethics clearance certificate was secured before starting my fieldwork. Based on the guidelines, the significance of informed consent and voluntary cooperation was explained to participants at the beginning of the research process. I verbally explained the purpose of the study and requested them to take part in the interview. Participant information sheets (PIS) (translated into Isizulu and Kiswahili for the Johannesburg and the Nairobi case study respectively) explained the purpose of the study and invited them to take part in the study. I handed the possible participants the PIS but the majority of them requested for a verbal explanation and did not want to spend time reading the sheet. After the explanation, I obtained consent for the interviews, photographs and audio recording from all participants verbally and invited them to sign the consent form but a majority gave verbal consent.

As previously discussed, (see Section 3.5), I did not envision giving monetary incentives to participants in the research but the pragmatic reality of the residents who participated in the study in Mukuru prompted me to rethink my position. A majority of the participants were micro-entrepreneurs who had to close their businesses to engage in the research. Since they took time off their business, I give each participant a supermarket voucher as a token of appreciation. Some authors have argued that where incentives are perceived as attractive, they can pressurize vulnerable and low-income participants to take part in the research (Head, 2009). In order to address this concern, I did not inform the participants about the payment before the interview so as not to undermine their voluntary consent and offered the supermarket vouchers at the end of the interview. However, given that the snowballing sampling technique was employed and participants were asked to refer other residents, it is likely that some of those snowballed residents were incentivized to participate in the research on learning about the tokens of appreciation. This situation was further proof that dilemmas in the research process are often resolved in a subjective way.

The consent of participants was sought for interviews and FGDs and their privacy was protected during fieldwork as well as in data coding, analyses and in reporting of the findings in the study Despite explaining the purpose of the research, residents still had expectations that participating in the research would change the water situation. However, I reiterated my position as a researcher and not an "informer" of the authorities. In Mukuru, a community leader expressed his frustration saying “research on basic services has been done here very many times but there is no change (Personal communication, community leader 2, 22-08-19). This comment indicated the fragility of my connection with the residents who had participated in similar studies in the past. During one of the FGD, a participant-resident appealed “please forward this information to the government so that they change the water situation because discussions cannot bring change unless they are forwarded to the government” (Personal communication, FGD, 20-10-19).

3.10 CONCLUSION

This chapter elaborated the fieldwork process that I undertook in order to address the research questions. The research employed multiple data collection methods for theoretical, data and methodological triangulation. Theoretical triangulation was achieved by employing multiple theories to interpret data; multiple sources of data provided opportunity for data triangulation while methodological triangulation was achieved by combining various methods. Equally, the foregoing discussions demonstrate that field work is inherently complex and messy contrary to the systematic and standardized processes and procedures that are recommended in social science research. The research process – selecting study sites, decisions on data collection methods and sampling techniques, data collection and interpretation as well as resolving ethical dilemmas – is also inevitably political and subjective. In addition, access to research sites and to respondents is a continuous political process of negotiation and renegotiation hence access to research sites/contexts is a cyclical and non-linear process. The discussions presented also raised some of the limitations, challenges and ethical dilemmas that I encountered in the fieldwork and how I resolved the issues in ways that would not jeopardize the credibility and validity of the research findings and the entire research process.

A reflective perspective on the effectiveness of the research methods and tools in addressing the research question reveals that the case study method was crucial in understanding the nuances with regard to the malleability of normative modes of water governance and power relations between diverse actors. Specifically, with regard to the first sub-question on conditions and challenges of access to water services, direct observation, in-depth interviews and transect walks were critical in gathering data required to address

the question. In order to adequately address the second and third sub-questions on actors and their practices, in-depth interviews, FGDs and transect walks were critical in collecting data. Direct observations were less crucial given that social phenomena are subjective making it difficult to make valid generalizations based only on observations. The limitations of data discussed in Section 3.6 (language barriers, absent voices and the timing of interviews) constrained the interpretation of findings since some perspectives and experiences on access to water services could not be captured. Given the scope and time frame of the thesis, these limitations have informed the recommendations for future research presented in Section 9.7.

CHAPTER FOUR

4 CONDITIONS AND CHALLENGES OF WATER SERVICES IN MUKURU SETTLEMENT

4.1 INTRODUCTION

This chapter presents data and analyses on the first sub-question which focuses on conditions and key challenges of water access, use and disposal in informal settlements. The chapter then derives the sub-findings on the baseline conditions and challenges of water services in Mukuru which is possibly the fastest growing informal settlement in Nairobi given that its population has doubled in the last ten years (IDRC, 2017). Overall, the chapter is presented in two major parts where the first part focuses on a review of policies and legislation on water services in Kenya mainly based on secondary data sources and discussions of water sources and providers based on primary data while also providing an overview on the evolution and development of the informal settlement. The second part presents the status quo on the physical, socioeconomic and demographic characteristics of Mukuru as well as the legal and institutional frameworks related to water services in Kenya which provide a foundation for water governance. It then moves on to explain the sources of water for the residents and the implications for quantity, quality and reliability of each water source.

The chapter therefore demonstrates how access to water services is mediated by an assemblage of infrastructure comprising material and non-material elements. The inequalities in access to water services by residents in Mukuru could be attributed to unequal power and control by actors over the infrastructure elements. By exploring the formal and informal interactions between diverse actors, the chapter reveals the porous boundaries state actors which increases the surface area of engagement between the state and other actors on diverse levels and on different scales (Heller, 2013). The analyses also demonstrates the simultaneous interactions of cooperation and competition among the cartels and state actors in the provision of water services in Mukuru which undercut the formal/informal as well as state/non-state distinctions. The chapter thus underlines the significance of social relations in access to water services. The conditions for water access, use and disposal are captured and narrated primarily as directly observed while the challenges are primarily narrated in terms of experiential interpretations based on the responses from participants.

Equally, the chapter reveals that residents of informal settlements are not merely passive recipients of the status quo but are equally active agents who, through infrastructural creativity, devise ways of dealing with

inadequate water services (Ballard, 2015). Finally, the chapter shows the integrated and interdependent nature of the different basic services making it impossible to disaggregate and attend to specific services in isolation. Thus, a holistic approach in addressing inadequate water services provision should incorporate other basic services such as sanitation, security and housing which are intricately related to water services. Overall, the chapter constructs a situation of complexity consistent with the assemblage theory reviewed in Chapter 2 (see Section 2.3) in which multiple layers of governance and actors are interlinked with overlays around issues of land, legitimacy and integrity. It shows how the complexity of governance impacts the overall services provision in the informal settlement.

The first sub-question helps the study to present the contextual facts on water access for Mukuru and thus primarily serve as the premises for data presentation and analyses on subsequent sub-questions (see Table 4.1). The presentation therefore takes a relatively descriptive approach where direct observations (primarily through transect walks and direct observation) and interviews as well as FDGs responses are systematically woven into the narration. Even though the sub-question is more oriented towards physical/material infrastructure, interview and FDG responses constitute the crucial lens for understanding the challenges. In other words, the conditions are captured and narrated as they are observed, but the challenges are primarily narrated in terms of experiential interpretations based on the responses from participants. In view of the above, Table 4.1 show how the approach to data coding and analyses was implemented (see discussions in Section 3.7 on data coding using the traffic lights model).

Table 4.1: Conditions and key challenges of water access, use and disposal in Mukuru

Key data themes guided by sub-question 1	**Sub-Themes**	**Secondary data** **Key data types and sources**	**Primary Data: Transect walk and direct observations** **Key data types and items**	**Primary Data: Interviews & FDGs Responses** **Key data types and items**
THEME: Conditions of water access, use and disposal	-Location, geographical extent & morphology	-Aerial maps and satellite images (no or minimal adaptation) – key sources IDRC (2017). -Muungano wa Wanavijiji (2018) -Weru et al. (2014) Land tenure in Mukuru.	-Grid street plan in MCC and Vietnam villages. -Ngong river and railway line cuts across the settlement.	-The types of ownership as: Title holders, structure owners and tenants. -The demarcation of Mukuru into sections. -Flooding of the houses during the rainy season. -Closeness to the industrial area.
	-History & growth	-History of the settlement IDRC (2017) report -Evolution and development of Mukuru Sverdlik (2017). -Slum Toponymy of Nairobi Wanjiru and Matsubara (2017)	-The changes in the quality of buildings. -The variation in the building materials used.	-Land occupancy over time. -Mukuru as a 'Dormitory' -temporary accommodation. -Executive settlement committee
	-Demographics & livelihoods	-CURI (2014) report on Mukuru -Ethnic composition of settlement in Mukuru Wanjiku (2014) -Population statistics KNBS report 2009.	-The economic activities in the settlement. -Variations in room layout and design.	-The diverse ethnic composition of the settlement. -The role of ethnic identity in the provision of services.
	Physical/Material infrastructure (including houses)	-IDRC (2017) report - AMT et al (2015) report on Mukuru	-The hydraulic infrastructure including the chambers, water points, jerricans at the water points etc	-Installation of chambers by the NWSC

	-Mechanisms of management-of-access Legal and institutional frameworks	-The Water Act, cap 372 state ownership of all water resources -Session paper 1, 1997 Decentralization of water services provision. -Water Act 2002 Separation of water services delivery and water management. -Water Act 2016; National and county governments shared responsibility of water services delivery -2010 constitution of Kenya: Universal right to water	-The queues at the water points	-The constitution of Kenya: universal access to water -The Water Act 2016: Devolution of water services to county governments.
	Institutional frameworks	-WASREB -WWDA -CGN -NWSC	-The NWSC satellite office (See Figure 4. 6)	-The informal settlements department -Responsibilities of WASREB, CGN and NWSC -Departments in NWSC -Challenges faced by NWSC and CGN -The challenges of grievance reporting to NWSC
THEME: Challenges of water access, use and disposal	Tenure uncertainties	-IDRC (2017) report -MMV (2014) report -CURI (2014) report	-The poor quality of the houses	-Public land comprises 20% of the settlement -Private land is leasehold land -Myriad of stakeholders -Lack of formal documentation -Multi-layered claims of ownership -Land contestations driving factor for chamber location.
	Affordability	-Crow and Odaba (2008) study in Kibera slum in Nairobi	-Price lists of water services displayed in ablution blocks	-The price is fixed by the cartels. -High price of water relative to their wages.

				-Higher prices during scarcity
	Quality concerns	-Sverdlik (2017) Study in Mukuru Nairobi. -Crow and Odaba (2008) study in Kibera slum in Nairobi	-The spaghetti pipes running from the chambers. -Water appears cloudy.	-Gastro-intestinal infections in adults and children. -Need to treat drinking water.
	Supply uncertainties	-The rationale for the chamber model and merits of chambers Castro and Morel (2008) -Infrastructural violence Ahlers et al. (2014) a literature review -Photos of chambers from reports: NWSC, IDRC *(2017)*	-Functional chambers -Abandoned chambers (see photos in Appendix 6) -Non-functional water points - Tanks and jerricans used to store water	-Persistent water shortages -Some sections are more affected by shortages.
	Policy/Rules uncertainties	-Sverdlik (2017) Service provision in Mukuru Nairobi -Crow and Odaba (2008) study in Kibera slum in Nairobi	State officials did not confiscate pumps belonging to some vendors.	-Residents are unaware of the rules. -The cartels make rules arbitrarily. -Unwritten rules

4.2 LOCATION, DEVELOPMENT AND EVOLUTION OF MUKURU KWA NJENGA SETTLEMENT

The settlement lies close to the initially established formal industrial areas and is one of the largest, fastest growing as well as poorest informal settlements in Nairobi (IDRC, 2017). It is also strategically located due to its proximity to the CBD and the city's industrial area of Nairobi (see Figure 4.1) which makes it highly attractive for many semi-employed or low wage workers in Nairobi (Wanjiru and Matsubara, 2017). The last population census in Kenya in 2009 shows that Mukuru kwa Njenga had a total of 27,389 households with 74,799 people dwelling on 247 acres of land (KNBS, 2009). The entire settlement comprises of three administrative areas which are; Mukuru kwa Njenga, Mukuru kwa Reuben and Viwandani (see Section 3.2.2 and Figure 4.2). Mukuru kwa Njenga falls under the ward of the same name and encompasses the informal settlement as well as formal residential areas and other land uses such as factories. The heterogenous land-use makes it difficult to disaggregate data pertaining specifically to the informal settlement which is geographically part of the larger ward (IDRC, 2017). Consequently, administrative officials face challenges in apprehending the unique threats to the informal settlement and how to address them adequately. Examining the evolution of the settlement is significant because hydraulic infrastructures comprise human and non-human elements in the present as well as the histories of those infrastructures (Bennett, 2010).

As one of the major rivers flowing through Nairobi and also a significant source of water supply to the city, Ngong River crosses through the informal settlement and is highly polluted by waste from industries and households located nearby on its banks (UNEP, 2003). The topography of the land generally slopes towards the river with parts of the settlement closer to the river susceptible to frequent flooding in the rainy season and hence are less populated compared to other areas within the settlement (see Table 4.1). Besides, the residents living in these underpopulated areas have less access to water services than the other parts of the settlement because the morphology and geological conditions make it difficult to reticulate services given that the soil (mainly clay or sand silt) cannot adequately support the infrastructure. A Kenya Railways line cuts across Mukuru kwa Reuben and Mukuru Kwa Njenga posing significant environmental and health risks to residents some of whom live in houses built on the railway reserve.

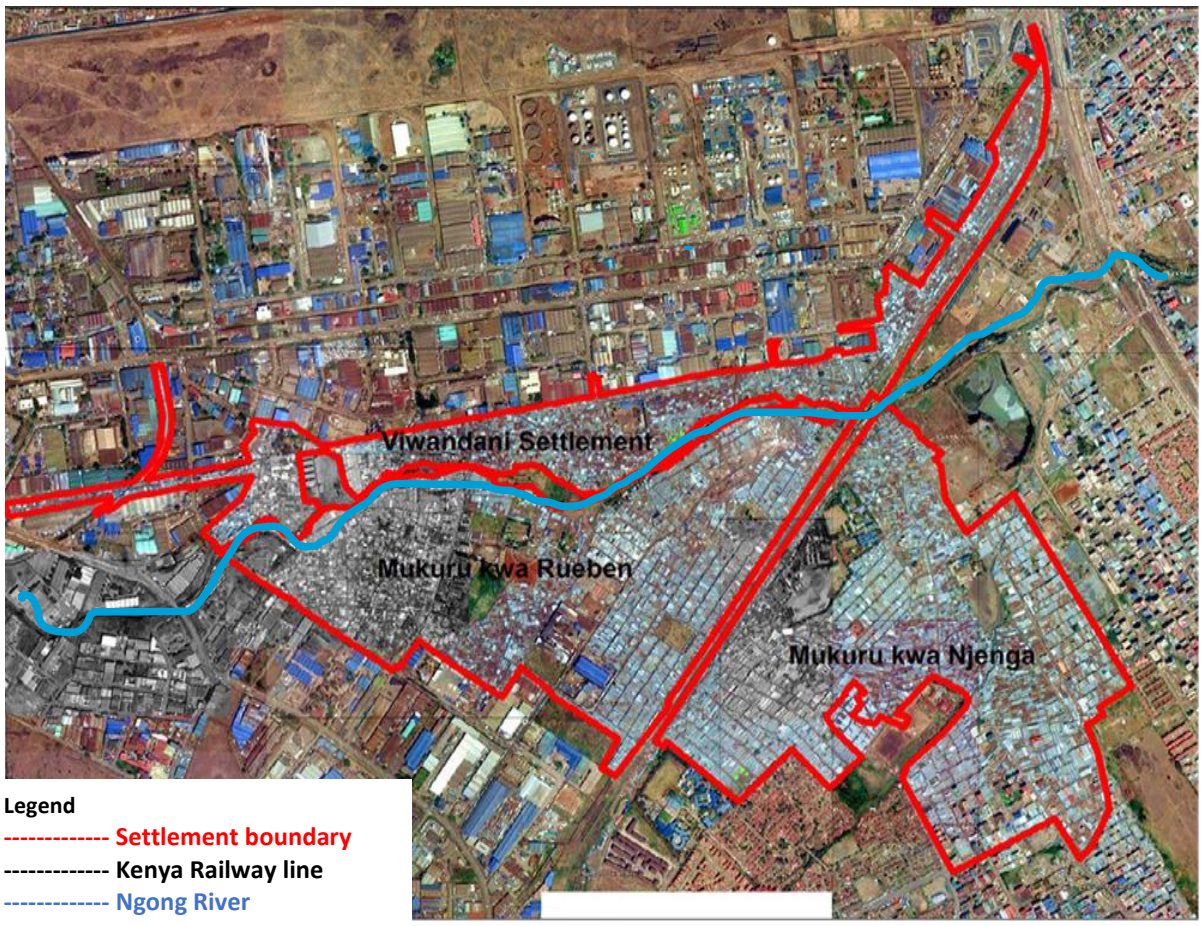

Figure 4.1: Modified map of the precincts in Mukuru informal settlement (Source: IDRC, 2017:24)

The settlement often acts as a "stopover" for people arriving from rural areas to settle while they look for job opportunities and better accommodation both within and outside the settlement. It has also been described as a "dormitory" in the sense that some residents see it as a temporary place where they go to sleep after work as they look for alternative accommodation (Personal communication, CGN official 3, 5-09-18). This point illustrates the fluid and dynamic movement patterns in and out of the settlement which poses difficulties in enumerating the population. Figure 4.2 shows satellite images of the growth and expansion of the settlement between 2002 to 2016. It demonstrates the rapid changes in the area with approximately 95% land occupancy in 2016 compared to 50% occupancy in 2002. Thus, the occupancy of the settlement as well as the population have almost doubled in the last 14 years (IDRC, 2017).

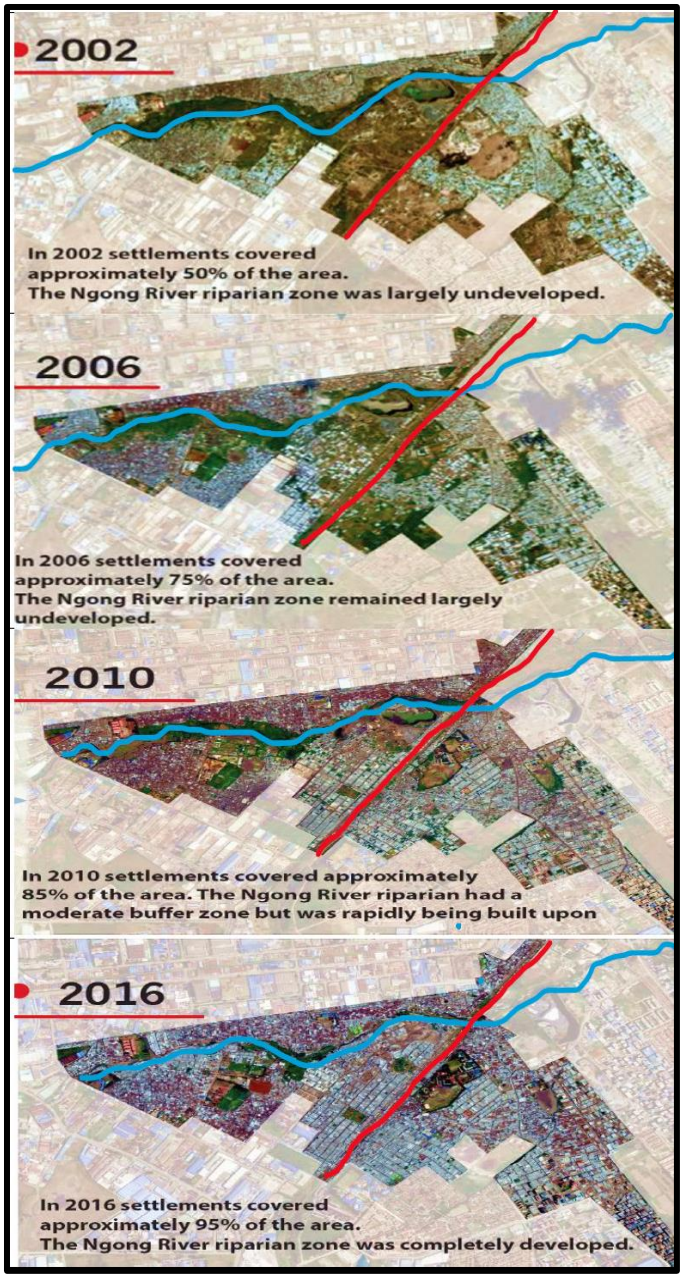

Figure 4.2: Modified Google Earth satellite images on the growth of Mukuru from 2002 to 2016. (Source: IDRC, 2017:14-15)

Social diversity makes Mukuru an interesting case of investigating micropolitics of water access. The settlement has a heterogeneous ethnic composition, with four dominant ethnic groups namely the Akamba, Kisii, Kikuyu, and Somali (Wanjiku, 2014). Ethnic considerations influence the choice of a newcomer's

residence in the settlement with new entrants preferring to reside close to people of their ethnic community. For example, the Somali tend to live closer to mosques and Khat (*miraa*) dealers. Further, ethnicity influences room design and layout of people's homes. For instance, in general Somali households have bigger yards and construct bigger rooms that have cooking areas and recreational spaces. The large space requirement among the Somali households is mainly due to the fact that they live with extended family members thus increasing the size of a household (ibid.). The large space requirement for the Somali due to the fact that they live with extended family members thus increasing the size of a household (ibid.). The provision of certain basic services is controlled by different ethnic groups with examples of water supply mainly dominated by the Kisii whereas electricity supply is run by Kikuyu dominated networks (Sverdlik, 2017). This will be elaborated further in Chapter 5.

In terms of political-administrative structures, Kenya is geographically subdivided into 47 counties which form the basis for the devolved political governance. Each county is further subdivided into sub-counties which are in turn divided into locations. Thus, locations and sub-locations are the third and fourth level of sub-division below the county respectively. Both the chiefs and sub-chiefs (responsible for the locations and the sub-locations respectively) are appointed public officials (civil servants) who exercise power and jurisdiction over a location or sub-location. As a sublocation, Mukuru kwa Njenga is further divided into eight villages namely Sisal, Milimani, Vietnam, Riara, Moto Moto, Wape Wape, Zone 48 and MCC (see Figure 4.3). Although the demarcations are not formally sanctioned, the villages are legitimized by the fact that they embody the history and experiences of the residents. Each village is headed by a settlement committee comprised of twelve members. The executive committee is made up of five members of the settlement committee namely the chairman, the chairlady and a youth leader and two other members co-opted by the three members. The executive committee is made up of five members of the settlement committee namely the chairman, the chairlady and a youth leader and other two members co-opted by the three members. The executive committee, "aids in the quick resolution of problems and oversees the day to day running of the settlement" (Personal communication, community leader 3, 23-08-18). The settlement committees are elected by community members at community elective meetings held as and when needed (ibid.).

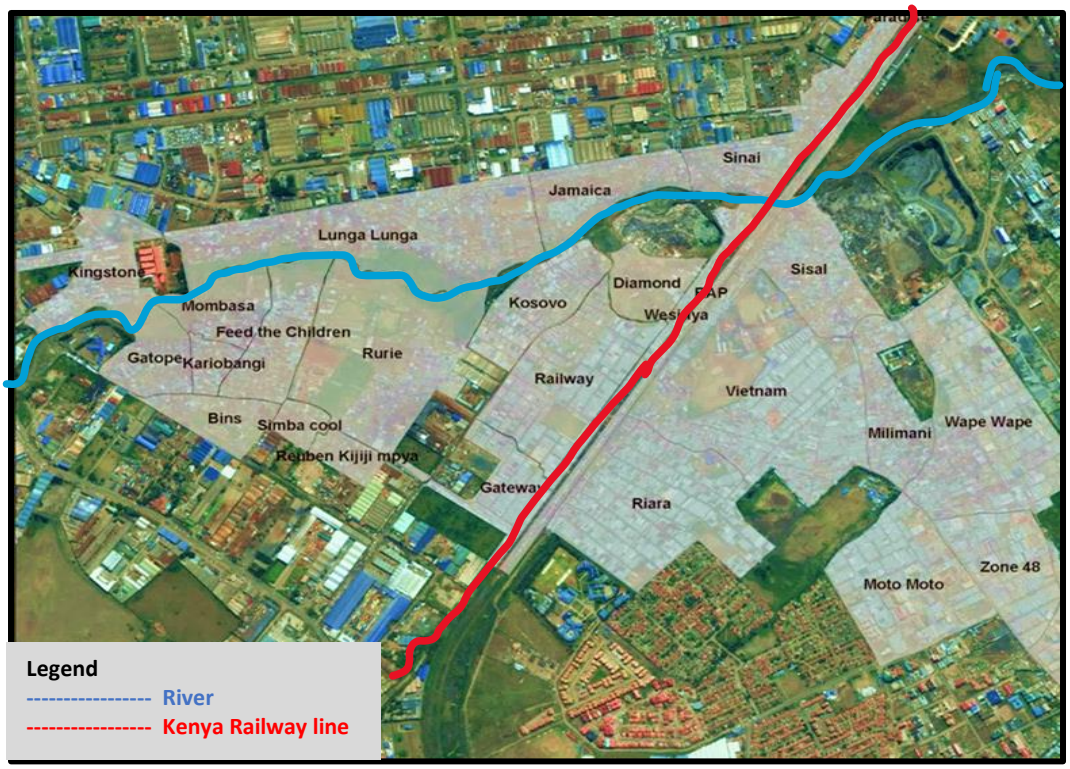

Figure 4.3: Mukuru sections or zones (Source: Nairobi studio, 2020)

The settlement committee exercises functions such as land issuance and land use control, security monitoring and dispute resolution ranging from domestic squabbles to land conflicts (Wanjiku, 2014). The interview responses suggested that administrative and governance arrangements in Mukuru occur outside the confines of the state whereby non-state actors such as the settlement committees have authority to formulate and enforce rules (which are not part of the state apparatus) but are collectively binding on members. The committee, and particularly the chairman has a significant role in the allocation and transfer of land as well as designating activities to specific parts of the settlement (CURI, 2012). For instance, the committee demarcates spaces for residential and recreational (such as playing fields) purposes. The influence and power of the village executive committee in the community is augmented by the fact that they deal with residents at the coal-face and on a daily basis. Chapter 5 presents further discussions on the role of the settlement committee in Mukuru.

4.2.1 Land Ownership and Land Use

The land tenure system in Mukuru is complex largely due to the history and evolution of the settlement. During the colonial period, sections of the land were sisal farms owned by white settlers who employed native

farmworkers (Wanjiku, 2013). Additionally, there were several quarries from which stones used to build surrounding factories were mined. After independence in 1963, the settlers handed over the sisal farms to farmworkers but shortly after the land was nationalised by the government of Kenya (ibid.). In the 1980s the government allocated the land to private investors and corporations through a conditional lease agreement for construction of light industries and payment of the requisite rent and rates. The lease conditions stipulated that the industries had to be put up in two years but most of the lessees did not comply with the requirements of the lease either by not building the light industries or by using the titles as collateral for loans from banks or transferring the land before development of the industries (CURI, 2014). Currently, there are several legal suits by lending institutions and initial title holders surrounding the ownership of the land, most of them seeking injunctions for demolition of buildings due to land disputes.

Thus, formal land tenure in Mukuru is categorized either as public or private land. Public land is held by the state for public use and comprises 20% of the settlement (IDRC, 2017). Private land is leasehold land granted by the state under certain conditions such as construction of light industries and payment of requisite rent and rates. Generally, land ownership in Mukuru is more perceived than legal since the legitimacy of title deeds is often disregarded by residents who claim that "*karatasi ni yao, ardhi ni yetu"* meaning that the title deed is theirs but the land is ours (CURI, 2014). A major contributing factor to this perception is that 94% of the land is owned by few people who are absentee landlords (IDRC, 2017). Acquisition of land in Mukuru is largely through the informal land delivery system that involves the chief, the settlement committee as well as the de facto landlords (CURI, 2014). A person interested in buying land in Mukuru negotiates with the settlement committee and later signs an agreement with the seller witnessed by the chairman of the committee and the chief. A 'certificate' with the name of the buyer, the plot number, identification number and the signature of the chairman is issued by the chairman of the committee. The name of the buyer is entered into a register under the custody of the chairman (ibid.). Further, when a person wants to construct informal structures, the chief and the committee must authorize the plan after the payment of a predetermined facilitation fees (bribe) to the chairman and the chief.

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committee and later signs an agreement with the seller and witnessed by the chairman of the committee and the chief. A 'certificate' with the name of the buyer, the plot number, identification number and the signature of the chairman is issued by the chairman of the committee. The name of the buyer is entered into a "register" under the custody of the chairman (ibid.). Further, when a person wants to construct informal structures, the chief and the committee must authorize the plan after the payment of a predetermined facilitation fees (bribe) to the chairman and the chief.

The chief is a key player in the informal land delivery system as he monitors all land exchanges and construction in the settlement. The settlement committee ensures that land transfers are in alignment with the informal plans of the settlement. Besides, the committee must be consulted before any constructions, renovations or extensions take place. In most instances, buyers are people who do not live in Mukuru but are looking for housing investment opportunities in the settlement (IDRC, 2017). The land ownership structure introduces a myriad of stakeholders and adds complexity to resolving service provision problems facing the residents of Mukuru due to different stakeholders' interests.

For example, the structures (houses) in the settlement have three levels of stakeholder claim which are the titleholder, the structure owner and the tenant. These multiple claims laid by different players in the settlement makes the land tenure contentious. These findings seem to suggest that the lack of secure land tenure makes it difficult to obtain the requisite permits to put up the infrastructure needed for the provision of basic services. The foregoing discussions reveal that land tenure in Mukuru is multilayered and multifaceted with numerous claims of ownership which adds to the complexity of governance of basic services in the settlement. Similarly, contestation among the three stakeholder categories about tenure further complicates the provision of basic services as elaborated in the following sub-sections.

Titleholders

This group comprises the initial formal title holders who acquired land from the national government both individuals and corporates (Weru et al, 2014). As explained above, given that the initial title holders did not comply with the lease conditions and left the land vacant, subsequent encroachment by squatters rendered the land inaccessible to the legal owners (those who held the title deed). Thus, the prevailing view is that land ownership in the settlement is more perceived than actual or legal even if perceived owners do not have the supporting documents they act as though they own the land (Akiba Mashinani Trust et al., 2015). The

appreciation of land value in Mukuru has led some title holders to initiate the process of repossessing their land through direct eviction of residents as well as through lawsuits. Despite the existence of the Eviction and Resettlement Act and powerful judicial precedents on eviction in Kenya, in practice evictions are executed brutally and without due notice (ibid.). As will be shown later in Chapter 6 this differs from the approach in South Africa where evictions and resettlements are legally enforced. This finding implies layers of complexity on land tenure in relation to development of infrastructure and provision of services.

Structure owners

Structure owners are landlords who develop the land by building rental houses typically made of tin. About 90% of the structure owners are absentee landlords while the other 10% live in Mukuru to protect their commercial interests (Huchzermeyer, 2011). As will argued in Chapter 6, this is a different scenario from the one in Kya Sands where a majority of the residents own their houses. Structure owners rely on the services of local brokers and agents such as local youth groups to collect rent and search for tenants. Interviews brought to light a key dynamic where most water vendors were also structure owners. A community leader explained that "water vendors and structure owners are the same and are now the owners of the village" (Personal communication, community leader 3, 24-08-18) (see Appendix 9 for typologies of structure owners). A resident outlined his trajectory of becoming a structure owner in Mukuru. He explained that "after paying some money, the chief gave me land. I invested in a water point to get enough money to build which I did after 3 years. The water and landlord businesses complement each other" (Personal communication, water vendor 5, 26-08-18). During the interviews, I learned that some landlords who owned water points provided tenants 40 litres of water daily as a marketing strategy for current and potential tenants.

Tenants

Interview responses indicated that although tenants comprise about 90% of the population they have no control over land issues in the settlement (Personal communication, community leader 2, 29-08-18). Even though there is no formal documentation (for example a title deed) issued for the transaction other landlords are informed verbally by the settlement committee about the transaction. An informal sale agreement is signed between the seller and buyer witnessed by a village elder, chief or chairman (Wanjiku, 2014, AMT et al., 2015). Subletting a room from an existing tenant is a prevalent practice in Mukuru. Thus, it is common to have more than one household sharing one room and splitting the rent payable.

4.2.2 Settlement Morphology and Service Provision

The morphology of the settlement is influenced by the history of the establishment of the zone in question, the topography, socio-economic factors such as proximity to a main road as well as the security of land tenure (AMT et al., 2015). Urban morphology is "architecture, street layout and different densities of habitation" (Chirisa and Matamanda, 2019:355). Morphology as the structure and pattern of the settlement, has implications for everyday life, the quality of life of the residents as well as service provision because the mode of service provision is at least in part dependent on the terrain and layout that the water crosses (Ahlers et al., 2014). Hence morphology influences and reflects the practices adopted by various actors. The fine-grained analysis of Mukuru shows a heterogenous grain spectrum ranging from highly refined to organic patterns. Highly refined patterns can be found in MCC and parts of Vietnam which are characterized by broad streets, grid street plan and high-rise buildings (AMT et al., 2015). The grid iron layout facilitates the provision of basic services due to easy access and mobility of the residents.

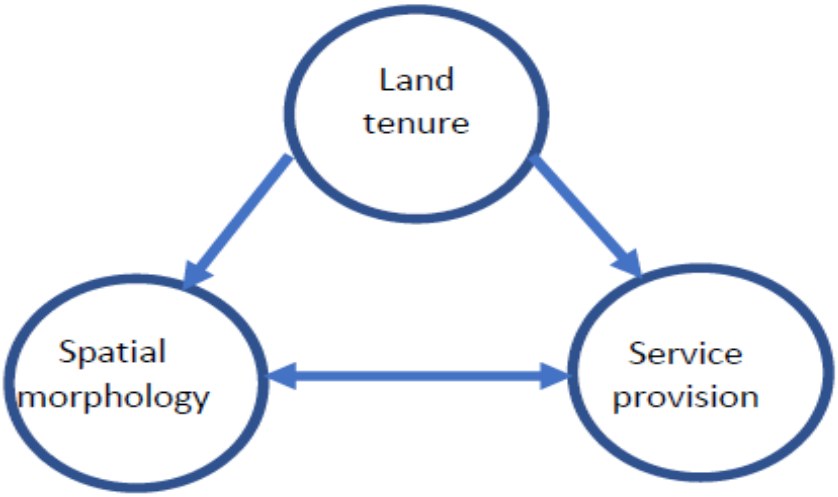

Figure 4.4: The tenure-morphology-service provision triad (Author, 2020)

On the other hand, organic patterns predominate in the older parts of the settlement such as Sisal and Milimani which developed randomly and are characterized by tin structures, dendritic streets, poor aeration and lighting. Organic grain poses challenges of flooding since most of the land comprises reclaimed flood plains thus affecting the residents' mobility and access to other parts of the settlement. Additionally, the dendritic streets which are often twisted, narrow and dark, poses risks such as falls as the residents carry water to their houses. The dendritic streets also make water reticulation difficult since service lines need to be aligned to the uneven street grid or placed underground which is expensive (AMT et al., 2018). Despite the high density, the narrow streets do not facilitate social engagements and interactions between residents

due to lack of light and outdoor spaces. Moreover, the wastewater drainage which runs next to the houses further exposes the residents to environmental and health risks. Organic grain is prevalent in areas with insecure land tenure since the investors hedge against the risk of huge losses in the event of evictions and therefore they invest in temporary structures. Overall, the prevailing morphological character of Mukuru is largely determined by uncertainties over the security of tenure.

From the above discussions, there is a link between land tenure, spatial morphology and service provision (see Figure 4.4). An important finding of this study is that reliable access to water services is largely dependent on the urban morphology. Given that the morphology changes across Mukuru, the quality of water services as well as stakeholders and their roles change rapidly overtime and location within the settlement.

4.3 CONDITIONS AND CHALLENGES OF WATER SERVICES IN MUKURU SETTLEMENT

4.3.1 Legal and Institutional Frameworks in Kenya

In order to gain a deeper understanding of the status quo and governance challenges of water services in Kenya as well as access to water services in Mukuru, it is necessary to examine the significance of related legal and institutional frameworks (see mechanism and institutional frameworks in Table 4.1). State laws, policies and regulations form "an assemblage of ideas, norms and precedents, with intentional and sometimes accidental effects (Meehan, 2014:216). Even though the legal and institutional frameworks are not the only elements of water governance, they constitute a critical part of normative water governance and therefore form a good point of departure for examining water governance in Mukuru settlement. Additionally, access to basic water services is a constitutional right in Kenya and therefore a focus on the legislative framework is necessary to gain insights into how people understand the universal right to water and the impact on the actors' behaviour in the settlement.

Moreover, an understanding of the notion of the right to water and how people conceptualize their rights in water access as well as the larger question of the sustainability of rights based development practices are crucial in gaining insights into the practices of people in access to water services. For instance, people in informal settlements might have long stopped relying on the state to access these rights, but it is important to understand the reasons why and the practices emanating from that perception. Further, the recognition of

water access as a right implies that water supply is not a privilege reserved for citizens who can afford and hence it grants power to hold the state accountable to fulfil the duty of service provision (Anand, 2015). This section outlines the evolution and development of the legal and institutional frameworks for water governance. At the end of this Section, Table 4.2 presents a summary of the legal and policy milestones with regard to the governance of water services in Kenya.

Before and after Kenya's independence in 1963, the Water Act cap 372 of 1952 governed the water sector which fell in the Department of Water Development under the Ministry of Natural Resources. This law stipulated that the government owned all water resources and was responsible for water services delivery to all the citizens. At the same time, the government was keen on seeking redress for historical injustices and inequalities of the colonial era. Part of redressing historical injustices was redistributing land formerly owned by white settlers to native Kenyans to achieve a basic level of social services which included water (DANIDA, 2010). In 1974 the National Water Master Plan enhanced the Water Development Department (WDD) into a fully-fledged Ministry of Water Development and proposed the provision of 'water for all by the year 2000'. The subsequent years saw mass development of hydraulic infrastructure throughout the country including borehole drilling, dam construction as well as reticulation of water pipes through donor funding both at national and regional levels (Nilsson and Nyanchaga, 2008).

During this period, the government promoted community action and self-help initiatives to accelerate economic development but gradually the projects were taken over by politicians as tools to gain political mileage. Although there was political will to implement the plan, challenges such as rapid population growth as well as fragmented planning at the regional level led to different styles of governance which threatened the achievement of the plan. Moreover, the donor supported projects incurred losses as soon as they were handed over to the local municipalities due to lack of managerial capacity to run the projects coupled with intentional misappropriation of funds. Up until then, the provision of water services took a state-centric approach and there was hardly any or no involvement of other actors in service delivery (Mumma, 2008). The lack of autonomy of the local authorities was politically motivated to ensure upholding the authority of the central government (Nilsson and Nyanchaga, 2008).

Session Paper no.1 of 1986 (Economic Management for Renewed Growth) by the Kenya National Assembly proposed the decentralization of water services provision to local governments through water utilities

whereby municipalities were commissioned to supply water to urban dwellers using the market model. In order to commercialize water services, the National Water Conservation and Pipeline Corporation (NWCPC) was created in 1988 through the State Corporations Act, Chapter 446 of the Laws of Kenya, so as to oversee the running of the government-owned water supply system (Mumma, 2008). Furthermore, the Structural Adjustment Programmes (SAPs) recommended a market-oriented approach to the economy and the reduction of state presence in running the economy. SAPs were conditionality-policies issued by the International Monetary Fund (IMF) to developing countries supposedly aimed at improving economic viability as a critical condition for receiving financial aid. Additionally, cost sharing in provision of public services such as health and water was also recommended to push the commercialization of public services (Akech, 2006). Commercialization of services shifted the state's role from being a direct service provider to an enabler of service provision (K'Akumu and Appida, 2005).

The realization that the government could not meet the 'water for all by 2000' target motivated the involvement of other players in the provision of water services to increase efficiency in operations and maintenance (Mumma, 2008 and Akech, 2006). Sessional Paper no.1 of 1999 on National Policy on Water Resources Management and Development (hereafter referred to as the Water Policy) addressed the challenges of the 'water for all by 2000' goal. The Water Policy proposed tariffs to ensure cost recovery and participation by non-state actors in water services provision and became the foundation of the Water Act 2002 which repealed the Water Act Chapter 372 of the laws of Kenya, which governed water services since 1962 (K'Akumu and Appida, 2005).

The 2002 Water Act created a complex dual system of governance that separated water resources management and water services delivery (Rampa, 2011). Equally, the system is characterised by "the intersection between policy formulation, regulation, service provision and consumption of the resource" (ibid.:3). The complex dual governance necessitated legal and institutional reforms to clearly define the roles and responsibilities of various state and non-state actors in water services provision and water resource management. Consequently, the reforms led to the creation of eleven water services and water resources institutions. For example, the Water Resources Management Authority (WRMA) was formed to manage water resources and Water Services Regulatory Board (WASREB) to oversee water services provision. With regard to the provision of water and sewerage services, the Act created Water Services Board (WSBs) and Water Service Providers (WSPs). The WSBs were appointed by the Minister of Environment and Natural Resources

to provide water and sewerage services in a particular jurisdiction and licensed by WASREB. Further, the WSBs were prohibited from providing water services directly to customers and could only provide services through an agent, designated as WSP.

Although the Act separated policy formulation, regulation and provision of services, it took a state-centric approach and presupposed a monolithic unitary state in the provision of public services. The 2002 Water Act, was premised on state-based legal frameworks which assume that the state has the requisite financial and technical resources to manage water resources and deliver water services. Together with separating water resources and water services management, the Act also differentiated the strategic policy making function from the tactical day to day operations and delegated functions to lower level public institutions. Equally and of importance to this study given its relevance to water services governance, the Act introduced the involvement of non-state players such as Non-Governmental Organizations (NGOs) in provision of water services (Mumma, 2008). Furthermore, by defining water services as "any services of or incidental to the supply or storage of water and includes the provision of sewerage services" Section 2 of the Act was silent on water services provision to marginalized and unplanned areas (GoK, 2002:944). The Act was criticized for its failure to recognize spaces such as urban informal settlements where both formal and informal rules coexist in the provision of water services (Akech, 2006).

Section 43 of the 2010 Constitution stipulates universal access to water as a human right and entrusts the responsibility of water provision to county governments. At the same time, article 56 addresses the need for marginalized and minority groups to access basic services through affirmative action. This legislation further charges the national government with the responsibility of regulating water resources and services as well as cross-county public works. Section 204 elaborates the Equalization Fund whose purpose is to improve access to basic services and amenities for marginalized areas and communities that were previously underserved. County governments are mandated with the role of developing the County Water Policy and the County Water Act that outline guidelines for water management.

The introduction of a devolved system of governance in the Constitution in 2010 necessitated the amendment of the 2002 Water Act to adequately address the implications of devolved basic services provision. Subsequently, the Water Act 2002 was repealed by the new Water Act in 2016 which was reformulated so as to fit the requirements of the new dispensation. This new Act addresses water resources and water

services management and recognises that shared responsibility between the national and county governments. Further, it stipulates the powers and functions of various institutions in water services in Kenya. In conclusion, the evolution and development of the legal and institutional framework sheds light on how the state has gradually changed its approach towards the provision of services to the marginalized.

Table 4.2: Summary of the legal and policy milestones on the governance of water services in Kenya (Source: Author, 2021)

Year	Legal and policy milestones	Highlights
1952	Water Act Cap 372	-Creation of the Ministry of Natural Resources. -State owns all water resources and is responsible for water services provision.
1974	National Water Master Plan	-Provision of 'water for all by the year 2000'.
1986	The Session Paper no.1	-Decentralization of water services provision to local governments through water utilities.
1988	State Corporations Act, Chapter 446	-Establishment of the National Water Conservation and Pipeline Corporation (NWCPC). -Corporatization and commercialization of municipal water services providers.
1990	Structural Adjustment Programmes (SAPs)	-Market-oriented approach to basic services provision. -The 'rolling back of the state' in service provision.
1999	Water Policy	-Cost recovery and participation by non-state actors in water services provision.
2002	The Water Act	-Dual system of governance of water resources management and water services delivery.
2010	The Constitution of Kenya	-Universal access to water services declared a basic human right -Devolution of provision of water services to county governments.
2016	The Water Act	-Shared responsibilities between county and national governments for water services.

4.3.1 Some Key Institutions in Water Services in Kenya

The foregoing discussions have pointed out the key institutions in the legal and institutional frameworks in Kenya. They include the Water Services Regulatory Board (WASREB) and Water Works Development Agencies (WWDAs), the County Government of Nairobi (CGN) and Nairobi Water and Sewerage Company (NWSC). Figure 5.1 shows the different layers of regulation and distribution of water services in Kenya. The

following sub-section provides further discussions on these institutions given their relevance in provision of water services.

Water Services Regulatory Board (WASREB) and Water Works Development Agencies (WWDA)

WASREB is the national regulator of the water sector and is mandated to ensure efficiency of WWDAs and Water Services Providers (WSPs) (Lehmann and Mudida, 2015). WWDAs are responsible for licensing, coordinating and monitoring WSPs which makes them power centres of both formal and informal interactions as well as a conduit to access resources and shape investment decisions (Rampa, 2011). Moreover, through its annual Impact Reports published since 2008, WASREB outlines and ranks the performance of all the WSPs in an effort to bring transparency to the sector. Additionally, the regulator encourages the formation of Water Action Groups (WAGs) which are community-based organizations (CBOs) that give voice to the needs of water consumers to ensure that their opinions are considered in decision making processes on water services (WASREB, 2010). Membership to WAGs is voluntary and members do not receive remuneration even though they function as the utility's representatives within the community. Their identity is thus blurred given that they belong to the community while also serving as company representatives. Additionally, *Majivoice* an information technology-based customer complaint system enables customers to file their complaints online or in person thereby giving the regulator the opportunity to monitor the complaints handling process and increase the accountability of departments.

There are eight WWDA (previously referred to as Water Boards) in Kenya charged with developing, extending and managing national public hydraulic infrastructure such as the bulk water distribution systems. Besides, the WWDAs provide technical support and training to county governments so that they can execute their duties. WWDAs also coordinate the installation and use of cross county assets and transfer of payments between the WSPs. However, while being technically strong, WWDAs have been considered the 'weakest links' in water governance due to their proclivity to be marred by political interference mainly through direct appointment of board members by the politicians as opposed to appointment based on technical and managerial competence (ibid.). The administrative boundaries were used to create counties and the WSPs while WWDAs were demarcated along natural water basins thus posing challenges for a WSP that falls under the jurisdiction of two WWDAs. The NWSC falls under the jurisdiction of the Athi WWDA.

The County Government of Nairobi and Nairobi Water and Sewerage Company

The CGN supplies water services through its WSP, the NWSC, to the residents of Nairobi. Prior to the new dispensation water services were decentralized to local water companies and community schemes though decision making remained largely centralized. Thus, creation of WSPs enabled the decentralization of decision making to the local authorities and application of business principles such as "efficiency, cost benefit analysis and profit maximization" in the operations of the company (Akech, 2006:6). Using the corporatization model, county governments such as CGN create WSPs (as separate legal entities from the local government) with the aim of increasing operational efficiency and economic viability in line with discussions on neoliberalism as presented in Chapter 2 (Bakker and Cameron, 2002).

NWSC was incorporated in 2003 as a private company limited by shares and fully owned by the CGN which is responsible for providing strategic direction to the company while the company is required to implement the strategy based on pursuing the specific performance targets and measures agreed upon under the strategy (Smith, 2006 and Budds and McGranahan, 2006). NWSC is generally considered to be the leading water utility company in Kenya mainly based on the fact that it distributes the highest amount of water and operates the largest water treatment plants in Central and Eastern Africa (Lehmann and Mudida, 2015). In order to enhance efficiency in service provision the company structured itself into six regions namely Northern, Eastern, North Eastern, Central, Southern and Western.

In 2008, the modalities of addressing the needs of the informal communities within this profit driven model came to light when the company restructured the regions based on two main factors. Firstly, the realization that increased hostility in informal settlements during the post-election violence in 2007 was driven by the fact that water was governed along ethnic lines. As such certain ethnic groups denied water to sections of the settlement occupied by people from other ethnic communities thereby intensifying the conflict (Personal communication, NWSC official 7, 20-08-18). Secondly, the Ministry of Water and Irrigation launched the pro-poor implementation plan for water and sanitation services (PPIP-WSS) in 2007 that prioritized strategies for addressing provision of water services to the urban poor. These two factors coupled with the proliferation of informal settlements motivated the establishment of the fully-fledged Informal Settlement Department within NWSC whose primary objective was to improve delivery of water services to the urban poor. Besides, NWSC has set up a satellite office in Mukuru settlement in 2016 a bid to provide speedy resolution of customer complaints (see Figure 4.5).

The department was responsible for installing the water services infrastructure in the informal settlements based on external funding from donors (such as the World Bank and the European Union) and subsequently handing over the infrastructure to the respective NWSC region to operate and deliver the water services (Personal communication, NWSC official 5, 26-08-18). Hence its main role was limited to installation and maintenance of the infrastructure. However, "increased population in informal settlements and the declaration by the 2010 Constitution that water access is a basic human right necessitated the creation of a region to cater for informal settlements so as to provide a homogenous service" (Personal communication, NWSC official 5, 26-08-18).



Figure 4.5: The NWSC office in Mukuru

With regard to the satellite office operations, interview responses from residents and water vendors indicated that, "not everyone knows where this office is located to lodge complaints and grievances. The point is that we do not trust NWSC's capacity to solve our problem" (Personal communication, resident 5, 28-08-18). A state official further elaborated the rationale for the upgrading of the department into a region as follows:

> "In 2015 a separate region was created for informal settlements in Nairobi because previously we would concentrate on the formal areas in the region to generate revenues while neglecting informal settlements which did not contribute to their revenue targets" (Personal communication, state official 7, 20-08-18).

During the interviews, I realized that the metering department staff were unaware of the abandoned chambers in Mukuru which the residents had pointed out to me during the transect walks (see Figure 4.6). An official in the operations department explained that "initially chambers were built on the periphery but as the settlement grew it became difficult to access them due to densification and insecurity" (Personal communication, NWSC official 4, 24-08-18). Another NWSC official disclosed that "the reticulation maps are not updated and we do not know the location of the chambers and pipes so we approximate the locations" (Personal communication, NWSC official 7, 20-08-18). The chambers were abandoned when they ceased to produce water as the NWSC officials could no longer access them due to settlement growth. Further, the NWSC officials revealed that coordinating the various departments is a challenge as the staff were oblivious of the "reality on the ground". This has led to fragmentation, dispersion and personalization of knowledge about water services among the staff of the company "since information about water services in the settlement is decentralized" (Personal communication, NWSC official 5, 26-08-18).



Figure 4.6: Abandoned chambers in Mukuru in Zone 48 and Milimani

During the interviews, NWSC officials highlighted that the challenges they faced in the course of providing water services to the informal settlement. Firstly, given that the law enforcement function is under the CGN not the NWSC, the utility has no power to take any direct action against offenders and has to rely on CGN law-enforcement officers which leads to delays. In an interview, a frustrated official asked, "how does one ensure that people pay for water if it takes six months for the wrongdoers to be prosecuted?" (Personal communication, NWSC 6, 20-08-18). The high amount of time and effort taken to prosecute offenders does

not deter offending residents to discontinue their wrongdoing. This is coupled with the fact that "the residents are not easily intimidated and are accustomed to violence so they are more forceful than you" (Personal communication, NWSC 7, 20-08-18). Further, the fact that NWSC is mandated to increase accessibility to water services for the urban poor in terms of availability and affordability while being financially viable which implies reducing the NRW (Non-Revenue Water) demonstrates conflicting rationalities in NWSC since some officials work towards achieving equity while others aim at efficiency and profitability (see Appendices 2c-1-P7 and 4b-3 for further details).

Secondly, a NWSC official explained that "half of the NRW in Nairobi is lost in informal settlements due to illegal connections" (Personal communication, NWSC official 5, 26-08-18). This has led NWSC to work on legalizing the illegal connections by encouraging water vendors with illegal connections to apply for a metered connection from the utility. In an interview, an official elaborated that "you have to think about the impact of the change since for many people illegal water is a means of livelihood" (ibid.). Further, the state officials revealed that this formalization process in Mukuru was political and power laden and generated inequalities among the water vendors especially the small-scale vendors who depended on the cartels for reliable water supply.

Thirdly, on the vandalism of the metal covers used to protect meters in the concrete chamber, the metal covers are stolen and sold off as scrap which leaves the meters exposed to the weather elements while creating a dumping site where residents dump solid waste and wastewater in the chamber posing challenges for meter reading. Moreover, accumulated rainwater, wastewater and solid waste damages both the meters and the chamber. A state official explained the reason for vandalism in Mukuru stating that it is a "mechanism through which the residents vent their frustration and anger on the state for lack of adequate services" (Personal communication, NWSC official 4, 24-08-18).

4.4 SETTING THE STAGE: WATER SERVICES SITUATION IN MUKURU

Approximately 1% of the residents of Mukuru have water in their houses while 6% have water in their plots (Sverdlik, 2017). Whereas there are several sources of water in Mukuru, the dominant source is the supply from Nairobi Water and Sewerage Company (NWSC) primarily through meter chambers located at strategic supply points at the periphery of the settlements. The chamber model is also referred to as the delegated meter model (DMM). In this context, a chamber is a large concrete box with several meters from which the

water utility sells bulk water to community groups and individuals for retail to residents. Chambers are clustered connections with lateral connections to individual water points (see Figure 4.7). Underdeveloped hydraulic infrastructure owing to disputed land tenure and the likely legal consequences from the ongoing contestations make the chamber model most appropriate (Castro and Morel, 2008; Personal communication, state official 7, 20-08-18).



Figure 4.7: On the left, the view inside a chamber. (Source: KFTS, 2008). On the right, pipe connections from the chamber. (Source: NWSC, 2019).

The chamber model is commonly used in informal settlements in Kenya and is designed to enable water services providers to partner with customers to provide water services through Public Private Partnerships (PPP) (Personal communication, state official 7, 20-8-18). Chambers are located on the periphery of the settlement along the main water supply lines (see Figure 4.8). Locating chambers long the main supply line facilitates control and monitoring by NWSC as well as accessibility for meter reading. Equally, this location of chambers makes it difficult for the residents to make illegal connections along the pipe that connects to the chamber. Since the residents can apply for a meter connection from the utility company this serves as a form of recognition by the state.



Figure 4.8: Existing water supply network in Mukuru (Source, MWW, 2021)

Using the chamber-model the NWSC delegates the responsibility of water services provision to community groups and individuals. A community leader explained that "NWSC builds the chambers and the residents invest in infrastructure to bring it to their homes" (Personal communication, community leader 1, 24-8-18). Two key features make the chamber system a preferred option; Firstly, the meters are placed in a lockable chamber making it accessible to NWSC officials only which mitigates meter tampering and preventing illegal connections being made prior to the meter (see Figure 4.7). Secondly, the delegated management of water supply enables decentralization of the provision of water services thereby allowing a customer-orientated approach to service delivery due to a vendor's proximity to customers (Castro and Morel, 2008; Personal communication, state official 7, 20-08-18). By implementing the chamber model in 2006, the company

envisioned that laying the infrastructure would address the inadequacy of the provision of water services in Mukuru. The densification and the organic growth of Mukuru have made it necessary to engage water vendors and extend water services beyond the confines of water chambers to the residents. Further, NWSC expected that master meter operators such as organized community groups and individuals would then apply for connections from the chamber to the houses or business premises (Crow and Odaba, 2010). This finding suggests that the provision of infrastructure does not always produce the expected behaviour in residents which is a key point in the people-as-infrastructure argument of the study.

Moreover, the distribution of chambers in Mukuru is heterogenous with the majority of chambers being located in areas with good road network to facilitate access by NWSC for meter reading and adding connections to the network. This points to the fact that informal settlements are not homologous entities but are spaces of layered inequality and divergence as argued by Bourdieu (1992) in Section 2.6. Therefore, residents who live closer to the road in areas such as Zone 48 have better access to water services than those in areas that have developed organically such as Sisal (see Figure 4.3). Typically, residents living in far distance areas such as Sisal walk longer distances to procure water and pay higher prices for it. Ahlers et al., (2014) use the term infrastructural violence to describe the deliberate innovative infrastructural adjustments and alterations used by actors to contest inequalities in service provision. Furthermore, illegal connections which are visible manifestations of contestation by the marginalized to access water services are a typology of infrastructural violence (ibid).

Soon after the installation of the chambers the company realized that they had been taken over by small groups of water vendors referred to as the cartels who controlled several meters at a go (Personal communication, state official 7, 20-08-18). Cartels are groups of market players who act as a single producer of a good or service with the aim of maximizing collective profits through anti-competitive mechanisms such as pricing, limiting supply or actively undermining competitor businesses. Several of the meters in the chambers were registered under different family members thus gradually transforming the chambers into family businesses. Interview responses showed that “the majority of the residents who apply for a connection do so with the intention of getting into the water vending business by turning such connections into a source of livelihood” (Personal communication, NWSC official 4, 24-08-18)

In the context of Mukuru, cartels are comprised of prominent individuals who have monopolized water services provision by taking over the operations around the chambers or the distribution of water from the chambers to control the water business. In an interview, a CGN official elaborated the emergence of cartels stating that "cartels arose to fill a gap in water services provision so they prefer to be called alternative service providers as they are problem solvers" (Personal communication, CGN official 1, 20-08-18). Even though CGN and the NWSC officials are aware of the influence of the cartels, reclaiming the chambers from cartels is a challenging process. In another interview, a NWSC official intimated the helplessness of the NWSC officials with regard to illegal connections stating that "after persistent but futile efforts we decided to leave some chambers to the cartels" (Personal communication, NWSC official 6, 20-08-18). Findings also point to the complex roles of cartels which combine collusion with state officials and the provision of other basic services such as security and electricity. Based on the above interviews with state officials, I argue that by ignoring the activities of cartels, the state constructs invisibility so as to avoid the complexity and intensity of the problems posed by cartels. The next section presents the typologies of cartels found in Mukuru.

4.4.1 Typologies of Cartels in Mukuru

The typologies of cartels were constructed based on data from in-depth interviews with residents, water vendors and key informants, FGDs as well as documentary review. Mukuru is characterized by heterogeneous cartels based on their relationships with formal/state actors in water provision which are dynamic and change over time and space (e.g. collusion or contestation). The typologies range from organized gangs to family cartels and chamber cartels. The discussions below provide a nuanced understanding of the composition and roles of cartels who differ according to the prominence of ethnicity, links to state actors as well as the degree of conflict, collaboration and competition. Moreover, the inclusion and exclusion of members into a cartel varies depending on the eligibility criteria. The power affiliations and the operational/behavioral characteristics are discussed for each typology. The rest of the section has been structured according to the three typologies which are; organized gangs, family and chamber cartels.

Organized gangs

The provision of basic services by organized gangs who levy taxes on residents for 'protection' are a salient characteristic of informal settlements in Nairobi (Crow and Odaba, 2008). The predominant gang cartel in Mukuru is the *Mungiki* which is an outlawed and secretive criminal gang of youths from the largest tribe in Kenya, the Kikuyu. A state official explained that, "ethnicity is a salient feature of these cartels and there are

rites conducted to become a member using blood and swearing an oath to secrecy" Personal communication, state official 7, 20-08-18). Gang members mainly reside in Sisal village (see Figure 4.3) and controls the provision of basic services including water, sanitation, transport and electricity in the area (Personal communication, NWSC official 11, 19-10-18). The gangs are hierarchically structured and often constitute themselves into a parallel state in the territory where they operate (ibid.). Interview responses revealed that collusion between gang members and state officials make their elimination difficult. A key informant stated that "the fact that some of the members are aligned to people in national leadership/politics and the police makes it impossible for the community to deal with them" (Personal communication, community leader 2, 18-09-18). The gang cartels are continuously changing in response to various social and political challenges. Media reports show that the *Mungiki* recently regrouped and changed its name to the Nairobi Business Community to escape persistent government detection and any possible elimination (Onsongo, 2017).

Family based cartels

These are long established water vendors who run family businesses and often collude with state officials at all levels to restrict competition in the water business using racketeering tactics such as erecting barriers to entry of new vendors, fixing prices and sabotaging competitors' assets (Crow and Odaba, 2008). Typically, it starts with a family member who begins the water business and as things pick up, he invites other family members to join the venture. A state official explained that, "these people came from the rural areas and saw an opportunity to sell water and asked their relatives to join them which explains why the business network is very strong due to blood ties" (Personal communication, NWSC official 11, 19-10-18). Another state official observed that "most of the cartels in Mukuru are family controlled and have invested heavily in the business" (Personal communication, CGN official 2, 22-10-18). This official further highlighted the role of inheritance of businesses in propagating the family cartels. Family cartels collude with state officials to create artificial shortage by disconnecting water supply to other vendors so as to increase demand and prices at their water points. Appendix 2c1-P7 presents further details on family cartels.

Chamber cartels

Chamber cartels regulate new meter connections at a particular chamber. Chambers are a critical confluence that demands collaboration between different water vendors but is also a source of intra-group conflict between them. The relations between the members of chamber cartels (sometimes leading to violence and killings) are precarious given that they are an ethnically heterogenous group. Sverdlik (2017) study of Mukuru

found that some water vendors ceased their water business due to the ethnic-based conflicts between various cartels. A water vendor stated that, “we have an elected chairman who takes our concerns to NWSC” (Personal communication, water vendor 2, 26-08-18). In an interview, a community leader further explained the role of the chairman stating that “he specifies the location of the water points so as not to interfere with the existing network” (Personal communication, community leader 1, 24-08-18). Given that water supply to a metered connection is intermittent, vendors depend on other connections from the organized gangs and the family-based cartels for reliable water supply. The bond between the chamber members is weak due to constant influx of members between chambers in the settlement. This suggests that stiff competition makes water vendors individualistic and less inclined to cooperate with other water vendors. However, the cartel members pool funds that are used to pay bribes to NWSC officials for the speedy repair of the chamber supply or to the police to release a member who gets arrested. A water vendor elaborated that “the group is useful because one gets protection from NWSC officials, the police and other cartels in Mukuru” (Personal communication, water vendor 8, 2-09-18).

4.4.2 Factors that lead to the dominance of the cartels

This section examines the key contributing factors for the progressive dominance and entrenchment of cartels in water services in Mukuru. Table 4.3 presents the responses on these factors based on various data tools. They include: Links with the state; Ethnic orientation and Hierarchy; Access to resources and technical knowledge.

Table 4.3: Factors that lead to the dominance of cartels

Factor	Interviews	Focus Group Discussions	Secondary Data Source 1	Secondary Data Source 2
a) Links with the state	Connected to state officials at different administrative and political levels. There are challenges in eliminating cartels.	The connection between the state officials and the cartels is precarious and fragile.	Hansen and Stepputat (2006) informal sovereigns in Lagos, Nigeria. Creation of relations of reciprocity to enable service delivery.	The links are constantly (re)created and (re)negotiated (Ahlers et al., 2014).
b) Ethnic orientation and hierarchy	First mover advantages. Clear hierarchical structure with a clear line of command for operations. Ethnic heterogeneity leads to conflict.	Ethnically alignment. Dominance by certain groups. The 'Kisii' main investors. Norms, rules of conduct and sanctions for violation of rules.	The composition of the various ethnic groups in Kenya (Rohwerder, 2015). Water mafia in Bangalore, India demarcated zones for selling water (Ranganathan, 2014).	Crow and Obada (2008) study in Kibera slum, Nairobi
c) Access to resources	Barriers to entry: Financial and technical. Technical skills to execute repairs.	Gathering intelligence from water vendors and customers.	Financial barriers: high cost of the material infrastructure and social networks (Mutinda and Otieno, 2015) study in Mukuru.	Deliberate innovative infrastructural alterations to contest inequalities in service provision (Ahlers et al., 2014).

Links with the state

The cartels are well connected to state officials at different administrative and political levels (see Appendix 4b for detailed interview transcripts). In a study of transport services in informal settlements in Lagos, Nigeria Hansen and Stepputat (2006) note that informal sovereigns in the form of slum lords functioned like the state and mimicked state like mechanisms. This study is relevant because cartels in Lagos are informal and are aligned along family or ethnic lines as in Mukuru. As such cartels cannot exist except by working with the "studied ignorance or tacit consent" of the state (ibid.:11). Further, informal sovereigns are transient, fluid and work towards instilling fear so as to gain loyalty and legitimacy. The strength of the links with state officials (which depends on the typology of cartel) poses challenges for dealing with and eliminating the cartels (see detailed transcripts in Appendix 4b). This finding corroborates Ranganathan (2015) study in Bangalore, India, that water tanker operators colluded with state officials to get illegal connections but at the same time the operators would publicly accuse the officials as being corrupt and lacking integrity thus suggesting a precarious association between them.

Ethnic orientation and Hierarchy

Interview responses by water vendors and state officials intimated that commonality of language and ethnic alignment provided a strong support system for the cartel members. Ethnic alignment provides economic support and a sense of belonging for the cartel members as well as protection in situations of adversity (Crow and Obada, 2008). During an interview, a state official elaborated that the Kisii have first-mover advantages since they were the first ones to identify the service gap in water services provision and then entrenched themselves in Mukuru (see Appendix 3c for further discussions on ethnic alignment). In another interview, a state official explained that "the Kisii dominate because when the water business started in Mukuru the senior NWSC officials were Kisii so they favored their own people" (Personal communication, NWSC official 7, 20-08-18). These responses demonstrated the collusive interactions between state and non-state actors in Mukuru. Responses from an FGD indicated that the other ethnic groups involved in water business such as the Kikuyu and Luo had clearly defined territories for business (see Table 4.1). The Kikuyu are the largest ethnic group in Kenya that occupies the central part of Kenya while the Luo constitute the fourth largest ethnic group (comprise 11% of the population) that occupies the Western part of Kenya (Rohwerder, 2015). Based on observations of some informal settlements in Nairobi, Sverdlik (2017) argues that ethnic dominance of cartels was mainly due to first mover advantages such that whichever ethnic group started providing the services enjoyed continued control of the business. Interview responses from water

vendors revealed that the cartels have a clear hierarchical structure that provides a clear line of command for their operations (Appendix 3c for further discussions). Further, clear norms and rules of conduct as well as sanctions for violating the stipulated rules within the hierarchy which governed the behavior of individuals, the members themselves and the interactions between the water vendors and residents (Personal communication, water vendor 5, 26-08-18).

Access to resources

Given the high initial investment costs of buying pipes, tanks, taps and pumps, water cartels benefit from barriers to entry into the water business. Besides financial resources, cartel members have the requisite technical skills to fix repairs quickly without having recourse to independent plumbers. Additionally, when the connection requires advanced technical know-how, former NWSC employees who are knowledgeable about the reticulation in Mukuru execute the repairs. A CBO leader said that "water vendors know how to connect pipes and pumps and to sort out the repairs" (Personal communication, CBO leader, 30-08-18). Besides, the networked supply from various sources which serve them on different days of the week provides the cartels with a constant supply of water. Equally, the cartels collect funds to create a pool from which they pay state officials so that the pipes are not confiscated and also acts as a source of business or personal loans for the member to enable them to expand their businesses by acquiring infrastructure to further appropriate water from the chambers. Given that the residents relied on electric pumps to increase the flow rate of water from the main pipe, they forged relationships with local officials to ensure that the pumps were not confiscated.

4.5 SOURCES OF WATER IN MUKURU

A discussion of the available water sources for residents in the settlement can reveal the status quo of water services and the challenges residents face in water access, use and disposal. According to Velzeboer et al., (2017) the different water sources define how water is accessed, controlled and exploited as well as how power is enacted to produce inequalities in access. Further, they argue that the choice of a water source is driven by fluid social and relational factors and hence individual choices are negotiated and articulated continuously. Besides discussing the various sources of water, the salient characteristics such as availability and reliability, quality and cost of water of each source of water are presented (see summary of water sources in Table 4.5). Ahlers et al. (2014) argue that residents make choices of water access based on factors such as reliability, quality, flexibility, affordability and preference for certain water vendors which are shaped by

cultural, socioeconomic and biophysical elements. There are three main sources of water in Mukuru namely water vendors, boreholes/wells and rainwater harvesting.

4.5.1 Water Vendors

The majority of the residents in Mukuru access water through water vendors. The next section discusses the factors influencing the choice of water sources with reference to water supplied by vendors. Through various data instruments data were collected, extracted, and analysed based on the first research sub-question. Table 4.4 summarizes the responses obtained.

Water availability and reliability

The residents reported that the water situation had improved significantly even though water supply was below the water demand. In an interview, a community leader explained that the water situation in Mukuru was not so much a question of availability as it is of management (Personal communication, community leader 4, 4-09-18). The residents further indicated that after the cartels took over, the number of water points closer to their homes increased. Figure 4.9 shows a water point operated by a water vendor. However, residents reported inequalities and uncertainties in access to water services given that residents cannot afford to pay for a meter connection. Besides, many of the water points are non-functional because "cartels control the supply so as to increase prices and profits" (Personal communication, community leader 4, 4-09-18). The residents disclosed that the small-scale water vendors depended on the cartels who decided when and how to supply water to the water point. Interview responses from residents further indicated that water services were interrelated and interdependent with other basic services such as sanitation and security. Likewise, residents revealed the impact of water availability on sanitation and health as well as on potential conflicts among residents. A resident explained that "we share toilets but some people here are unhygienic which exposes our children to diseases and people quarrel because of that" (Personal communication, resident 9, 05-09-18).

Table 4.4: Summary of the characteristics of water supplied by water vendors

Factor	Interviews	Transect walks/observation	FGD	Secondary sources
Availability and reliability	-Cartels create artificial water shortages. -The number of water points in the settlement increased and water is closer to homes.	-Figure 4.9 shows a water point.	Interrelatedness and interdependency of water services and other basic services. Influence of information and social networks on water access.	Anand (2017) study in Mumbai, India. Inclusions and exclusions of access produced by temporality of water supply.
Quality	-Poor quality of water supplied. -Low quality pipes. -Water appears cloudy or has a foul smell.	Figure 4.10 shows photographs of water pipes running in unsanitary conditions in Section 48 and Moto Moto.	Breakage of plastic water pipes which contaminates our water. Drinking water must be treated.	Crow and Obada (2008), Nairobi, Kenya.
Affordability	-Water points are closer to homes but water is expensive. -'Pay as you go' system is penalizing.	Observed residents paying water vendors for amounts purchased without negotiations.	Cost of water includes time spent looking and waiting for water.	Pryer, Rogers and Rahman (2005), Dhaka, India



Figure 4.9: A water point in Sisal Village operated from a vendor's house.

The residents pointed out the impact of temporality and intermittency in the availability of water services on their everyday lives. One resident disclosed that “when water goes, we look for it since we are uncertain when it will come back” (Personal communication, Resident 7, 23-08-18). This finding indicates how temporality of water supply in informal settlements produced inclusions and exclusions of access based on how residents share information among their social networks (see Section 5.4.5.1). As a result, water rationing schedules generated specific modes of interactions between the residents and the state in Mukuru as well as at intra-household and inter-household levels. This points to the impact of water schedules on the everyday lives of households such as when or whether certain activities will be carried out. Besides, “the pipes in Mukuru are above the ground and prone to breakages and leaks which lead to varying pressures that generate intermittent flow of water which eventually stops sometimes forcing us to negotiate with the cartels” (Personal communication, water vendor 5, 26-08-18). Overall, cartels play an important (though many times problematic) role in Mukuru especially in relation to increasing flexibility and accessibility to water services.

Quality

A dominant concern for the residents was the poor quality of water. Moreover, water is distributed through low quality pipes constructed by the cartels, which snake through unsanitary conditions in the jerry-rigged wastewater trenches (see Figure 4.10). Several pipes are joined in order to cover the distance. These pipes leak at the joints thus posing the risk of water contamination which can potentially result in outbreaks of

diseases such as cholera and typhoid (WHO, 2013). The likelihood of water contamination is higher in periods of water shortage as vendors tend to procure water from unmonitored sources including open wells in nearby quarries. A resident asked a rhetorical question, "surely can water that comes in contact with the sewage be considered reliable?" (Personal communication, resident 9, 05-09-18). The majority of the residents explained that they treated drinking water elaborating that "we boil or treat drinking water with chlorine to kill germs" (Personal communication, FGD 2, 20-10-18. During the transect walks I observed that several water pipes were joined together to reach the water point and there were leaks at the joints. A community leader explained that, "cholera outbreaks and other gastrointestinal infections affect children due to contamination of water (Personal communication, community leader 3, 24-08-18). See Appendix 2c and 3b for detailed transcripts from FGDs and interviews.



Figure 4.10: Water pipes running in unsanitary conditions in Section 48 and Moto Moto Villages

Affordability

The cartels dictate the price of water and the residents have little control over the pricing. Interview responses from residents indicated that although the cartels brought water closer to their homes, they paid more for it. Based on a study of service provision in Mukuru, Sverdlik (2017) found that although the water business is competitive and individualistic, it requires harmonized price control and barriers to entry. See Table 4.3 and Appendix 3c for more details. Thus, the residents had minimal leverage on the price of water which left them vulnerable to the autonomy of the vendors who were largely unregulated. Equally, some residents pointed out that the price was high relative to their wages. A resident disclosed that, "the price is high especially if you are unemployed or you earn little" (Personal communication, Resident 7, 23-8-18). The residents incur additional costs to treat the water which in all likelihood is usually contaminated. Moreover, prices are only

knowable and manageable in advance when water supply is stable but become fluid in periods of water shortage.

The “pay as you go” system penalizes residents who are not able to take advantage of the water tariff lifeline of 0 to 6 kilolitres prescribed by WASREB (Personal communication, senior manager, Kenya Integrated Water, Sanitation, and Hygiene (KIWASH), 29-08-18). The regulator recommends water tariff lifeline through the “social block tariff, charging a lower percentage of the average tariff (e.g. 50-70%) for the consumption of up to 6m³” (WASREB, 2018:21). Besides, the KIWASH manager also pointed out that pro poor prices are politically motivated and do not result in price reduction because, “the recommended price by WASREB is Kshs. 2 per 20-litre gallon while CGN recommends 50 cents for 20 litres but this is only a political statement” (Personal communication, senior manager, KIWASH, 29-08-18).

Interview responses from water vendors and residents revealed differences in the price of water in Mukuru depending on the location, the day of the week and the choice of queueing system (See Appendix 2c). However, a water vendor explained the rationale for differential pricing saying that, “pricing depends on the topography, the distance between the village and the chamber because of connecting pipes and pumps. The cost of running the pump increases the price because you need electricity” (Personal communication, water vendor 5, 26-08-18). Besides, the demand for water is higher over the weekend as most people engage in water intensive activities such as laundry. The findings from this study suggest that performance altering devices such as water pumps are an important part of the hydraulic infrastructure in underserved areas. See Appendix 3c-8 for detailed transcripts of interviews with water vendors.

Discussions with residents further revealed that the cost of water was not only the money that they paid in exchange for water but also included the time spent walking to the water point and waiting time at the queue, the energy spent carrying water on their heads or backs or the cost of hiring someone to ferry the water as well as the emotional anguish of moving from point to point looking for water (Personal communication, FGD 2, 20-10-18). In an interview, a resident indicated that “I choose the water point where I have a relationship with the vendor so as to get credit” (Personal communication, Resident 4, 28-08-18). Given that water vendors are aware of the crises that residents face, credit facilities are given to regular customers (see Appendix 3c-5 for more details on discussions of the mode of payment). This is similar to Sverdlik’s (2017) observations in Mukuru where tensions between the profit motive and socially embedded service provision

were evident mainly due to close personal contacts that informal service providers have with their customer-residents.

4.5.2 Boreholes and Wells

Given the high-water table in Nairobi (sometimes upto 70 metres deep) drilling boreholes is a viable option for water access for residents of Mukuru (Onyancha and Getenga, 2013). Further, documentary review of the geochemistry of the ground water in Nairobi showed a high propensity for microbial contamination of boreholes and wells in addition to *E.coli and coli* bacteria in water (ibid.). Since Mukuru is located in the vicinity of an industrial area the probability of contamination of the water by heavy metal and microorganisms is high thus making the quality of water problematic. The settlement has eight privately owned boreholes which are operated by institutions such as schools or faith-based organizations but currently only two are functional (see Figure 4.11 and 4.12). The residents can buy water from the borehole operated by the mosque during moments of extreme water scarcity. During an interview the *Sheikh* at the mosque intimated that, "the borehole water is for ablutions before prayers and we only sell it in desperate times" (Personal communication, religious leader 1, 23-08-18).

Interview responses by residents revealed that due to the poor quality of the water, boreholes are a measure of last resort. Some residents explained that when water shortage was protracted, the queues at the borehole were extremely long and sometimes it took an entire day to procure brackish water with limited uses. However, the residents disclosed that they used borehole water for cooking and drinking in cases of acute water scarcity. Residents reported that although boreholes were a viable solution in times of water scarcity they frequently broke down thus incurring high maintenance costs. In addition, residents intimated that borehole repairs took long hence many of them were abandoned. A community leader explained, "we have been looking for donors to rehabilitate the boreholes to no avail" (Personal communication, community leader 3, 23-08-18).

Wells on the other hand were dug in the quarries around the settlement while shallow wells were accidentally discovered around or inside the houses. A water vendor explained that, "I was repairing the floor of my house when water sprang up" (Personal communication, water vendor 7, 23-08-18). During the interviews, I learnt that residents who had wells were careful not to disclose to their neighbors. Upon probing the same water vendor disclosed that, "I do not sell the water from the well as my neighbors will keep disturbing me asking

for water" (ibid.). Interview responses from a resident showed apprehension about the quality of water from boreholes and wells. He stated that, "during periods of water scarcity handcart pushers sell water from wells and boreholes which looks cloudy and has a peculiar smell" (Personal communication, resident 9, 05-09-18).



Figure 4.11: A functional borehole operated by a mosque



Figure 4.12: A functional borehole owned by a local primary school

4.5.3 Rainwater Harvesting

Rainwater harvesting involves collecting rainwater from roof tops to fill a tank (or another waiting vessel) or to replenish a well. Rainwater harvesting reduces the need to purchase water from external suppliers as well as localized flooding. Literature reveals that rainwater is channeled in such a way that it diverts from the state infrastructure thus alleviating stress on the existing hydraulic infrastructure that would otherwise be used to supply water thus altering the way households manage their water (Meehan, 2013). However, the rainwater may be contaminated during the harvesting process due to atmospheric pollution or through contaminated conveyancing systems (Jacobs et al., 2011).

Poor sanitation and the use of 'flying toilets' (plastic bags used for open defecation and discarded on rooftops making the place filthy) by residents makes the practice of rainwater harvesting unreliable due to quality concerns. . I observed that households had installed rudimentary rainwater harvesting systems such as plastic sheets used to direct water into waiting containers under the roofs. The households become at one and the same time suppliers and users of water which reduces dependency on the external suppliers. I observed that high population density limited the volume of water that residents collected due to limited catchment area (small roofs) and lack of storage capacity as well as storage space in their homes.

Equally, a resident explained that, "we only collect water after the first run-off of rainwater which contains a high concentration of contaminants has cleaned the roofs" (Personal communication, FGD, 1, 01-09-18). A water vendor disclosed that "we still sell water in the rainy season since people do not trust the quality of rainwater" (Personal communication, water vendor 6, 24-08-18). Both views indicated that the quality of rain water was doubtful which was supported by documentary review that rainwater may not be potable without treatment though it can be used for other purposes such as washing, agriculture or cleaning (O'Brien, 2014). Harvesting rainwater is advantageous since it is cost free and provides water close to the household thus cutting down on the time and money needed to collect water. However, the temporality of rains makes rainwater harvesting an unreliable source of water because people cannot collect water unless they are in the house when it is raining. Moreover, the residents explained that health officials were discouraging harvesting rainwater due to frequent cholera outbreaks (Personal communication, FGD 2, 20-10-18).

Table 4.5: A summary of the sources of water in Mukuru settlement

Source of water Characteristic of the water	Water vendors (includes the cartels)	Borehole and wells	Rainwater harvesting
Availability	The distance to the water point varies with the location. -Water is relatively available.	Two functional boreholes and privately controlled.	Access during the rainy season.
Quantity	The quantity is limited by the buying capacity and the length of the queues as well as availability of water.	Easier to get sufficient quantities as water is cheaper.	Quantities harvested depend on the surface area of the roof and on rainfall amount.
Cost	- Relatively high and volatile prices.	Expensive to drill and maintain boreholes. -Stable prices.	Cost free
Quality	-A wide range of household uses but drinking water must be treated. -Visible and exposed infrastructure. -Possibility of contamination during transmission.	Poor quality (salinity) of water. -Limited household uses such as washing clothes and cleaning.	-Contaminated hence limited uses. -If clean can serve a variety of uses.
Intermittency	Water rationing is relatively frequent.	Frequent breakdowns.	Depends on the season.
Predictability	The water supply is unpredictable since the rationing schedules are unreliable	Water is always available.	Depends on the season

4.6 WATER USES AND DISPOSAL

Residents indicated that households had similar patterns of water use as water was mainly used for domestic purposes such as cooking, washing, bathing and sanitation. They also disclosed that the amount of water purchased and consumed depended on related uses as influenced by size of household and the money available. A majority of the residents procured water on a daily basis and on average daily consumption was

about 80 litres per household which is equivalent to four 20-litre plastic jerricans commonly used by residents to ferry water from the water points and to store water in their houses (see further details in Appendix 3a-1). During the interviews and the FGD, some residents indicated that water was also used for their businesses such as vegetable vending or running cooked food kiosks. Thus, inadequate water services impacted both on their well-being and livelihoods. A resident revealed how water scarcity affected his vegetable vending business saying that, "I lost customers as I had no water to keep the vegetables fresh" (Personal communication, resident 6 interview, 07-09-18). During the FGD, a resident disclosed that, "my laundry business requires a lot of water so looking for water stresses me" (Personal communication, FGD, 06-09-18). Additionally, Muslim residents use water for religious ablutions and cleansing as stipulated by the norms and customs of Islam as explained in an interview response by a religious leader: " it is compulsory for Muslims to wash the mouth, arms to the elbow, the face, head and feet several times daily before devotions" (Personal communication, religious leader 1, 23-08-18).

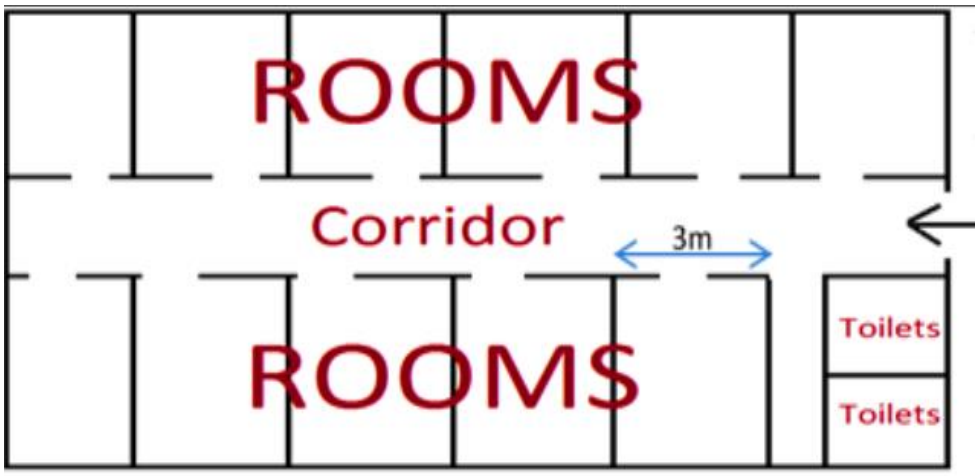

Figure 4.13: A layout of the typical housing 'plot'. (Source: Wanjiku, 2014:51)

With regard to water disposal, the residential structures in Mukuru typically comprise 10 to 12 rooms as shown in Figure 4.13. The rows of room are separated by a corridor which is multifunctional and is used as a drying area for clothes, an access passage to the rooms and a recreational area for both children and adults. Besides, it serves as a drainage channel for households disposing of small amounts of water (Wanjiku, 2014). I observed that the drains on the corridor joined bigger drains outside the structures. Large quantities of water are disposed of in the main channels which drain into Ngong River. People living close to the river dispose of water directly into Ngong River as shown in Figure 4.14.



Figure 4.14: An effluent pipe (circled) emptying wastewater into the Ngong River in Sisal Village

Although the typical housing structure is a ten by ten feet single floor block with corrugated iron sheet walls and roof, increasingly there is a rise in vertical orientated iron sheet structures (two-storey) to cater for the increasing population and resultant demand for housing. Residents living on the first-floor dispose of water on the corridor which drains through a pipe that empties into an open trench as shown in Figure 4.15 and Appendix 6a. The residents explained that they preferred to dispose of wastewater in the open trench because, "the wastewater pushes the solid waste down the drain" (Personal communication, community leader 3, 24-08-18). The visibility of water pipes and wastewater open trenches in Mukuru are contrary to Kaika's (2015) argument that through 'selective porosity' clean hydraulic infrastructure is visible while the wastewater infrastructure is invisible to create an autonomous hydraulic infrastructure for both systems. In Mukuru, material/physical infrastructures for both clean and wastewater are visible and mutually dependent since the clean water pipes run inside or along the wastewater disposal trenches. Residents indicated that wastewater disposal was a challenge in the settlement.



Figure 4.15: Wastewater disposal pipe (circled) from the first floor of a vertical structure in Vietnam Village

A resident explained that “in different community meetings water disposal issues such as blocked sewers and the widening the trench are discussed” (Personal communication, resident 12 interview, 07-09-18). This same resident further disclosed that, “during meetings community leaders mobilized people to unblock the trenches instead of waiting for the state” (ibid.). Moreover, during a transect walk, I observed residents as well as children drawing water from the open trench (see Figure 4.16). In the mid-ground of the photograph there is a visible sewage manhole (circled) passing through the open trench but no attempts have been to connect its waste drainage to the sewage system which suggests the simultaneous presence/absence of wastewater disposal infrastructure. A community leader explained that “when there is no water, we use the dirty water to clean the toilet” (Personal communication, community leader 4, 28-08-18). Besides, I observed that there was a foul smell emanating from the open trench and the prevalence of rodents posing serious health risks for the residents.



Figure 4.16: The open wastewater disposal drain in Zone 48 (see formal sewage manhole – circled, but no connection for the settlement)

Box 4.1 contains excerpts from the field diary on water disposal in Mukuru. This was further corroborated by a community leader who stated that "we realized that we cannot rely on the state to solve our problems" (Personal communication, community leader 3, 29-08-18). As a result, the residents undertake to widen and unblock the trenches when the need arises. Additionally, interview responses from residents and community leaders revealed that water disposal was a frequent cause of interhousehold and intrahousehold conflicts. A resident expounded that "quarrels begin when people dispose of wastewater on the walkway making it muddy and impassible" (Personal communication, resident 6, 07-09-18).

Box 4.1: Excerpts from field diary on 26-08-18

I sat in the ablution block office waiting for the meeting to begin. The smell from the open trench with wastewater and from the functional toilet run by the self-help group filled the room. The trench has wastewater and solid waste including human waste. A food vendor went about her business preparing food that she was going to sell right outside the ablution block and the open trench. I was baffled! She disposed her wastewater directly into the open trench. At about noon, customers arrived to buy food giving little importance to the unsanitary conditions in which the food was prepared.

4.7 INITIAL REFLECTIONS ON CONDITIONS AND CHALLENGES OF WATER SERVICES IN MUKURU

This chapter presented data and analyses on the evolution of policy and legislation related to the governance of water services as well as the existing institutional frameworks in order to reveal the disjuncture between the requirements of provision of water services and the everyday realities of heterogenous access to water services on the ground. This connection is critical to the question of governance of water services because the disjuncture generates non-normative modes of social relations between actors with practices that are outside the confines of the state. Thus, both the normative and informal negotiations, engagements and contestations are constitutive of the governance of water services in the settlement. Mukuru residents rely on a composite of formal, informal and self-supply sources of water which are contingent on interlinked multiple types of hydraulic infrastructure. Further, the chapter demonstrates how the hydraulic infrastructures structure practices and how they are structured by actors' practices. Hence, although infrastructures are constructed with the expectation that certain practices will transpire, the emergent practices do not always happen as anticipated. As discussed in Section 5.4.2.1, the trappings of formality enable the water vendors to acquire a legal water meter and simultaneously make invisible illegal connections to other vendors while leaving the legal meter visible during inspections. The case demonstrates the blurriness and porosity of the boundaries between the formal and informal categorizations in water services provision. Likewise, the disaggregation of the state provides an interface for the encounter of certain groups (who would otherwise be left out) and non-normative modes of governance by changing the dynamics in decision making (Heller, 2013). Further the disaggregation provides evidence on the porosity of the state since the surface area of engagement with state officials at different levels becomes significantly enlarged.

The case shows the significant role of social networks, rumor and speculation in the access to water services for the residents. As the distance between the state and the residents increases, the legitimacy of the cartels who were perceived by the residents as solving a problem is amplified (Ngunyi and Katumanga, 2014). The social embeddedness of cartels in the settlement as well as their collusion with state actors contributes to their dominance in water services provision. Hence the cartels decide to whom, when and where water will be provided and this discretionary access to water services exposes the vulnerable groups (those with limited social networks and capital) to greater exploitation by the cartels. This finding demonstrates the crucial role of social relations in accessing water services in Mukuru.

Further, waiting on the queue is characterised by changing rules and levels of anxiety due to the uncertainty about whether or not access to water services will be gained. Uncertainty of access to water services creates room for negotiations between residents which render the normative modes of governance malleable particularly at the point of water access. Equally, uncertainty leads to anxiety that often degenerates into intrahousehold and interhousehold conflicts. Queuing offers an opportunity for them to build social networks which are useful in accessing water services in future in line with reviews on social capital in Section 2.6 Besides, people waiting in queue for their turn to procure water and thereafter carrying plastic jerricans and buckets points to the visibility of people-as-infrastructure. Equally, temporality in water access is produced by water schedules that keep residents waiting for their turn to be supplied with water and the hurry (which generates anxiety) to the water points when it returns. Moreover, social relations between the residents are also broken on the queue as each household tries to collect sufficient water to meet its daily requirements.

The creation of social relations to gain and maintain access to water services is an iterative process requiring constant (re)negotiations. Besides, the power of each actor as well as the networks among the actors account for the heterogeneity of experiences with regard to access to water services. In line with the working hypothesis, the conditions and challenges of access to water services in Mukuru engender non-normative modes of governance as primarily typified by contravention of rules to create spaces for (re)negotiating access. Given that failure of infrastructure to deliver water services leads to questions on the decision-making process on water services, the next chapter addresses questions such as who makes the decisions; decisions about what water?; when and how are decisions made?; and who gets heard in the decision-making process?

CHAPTER FIVE

5 ACTORS AND THEIR PRACTICES IN THE GOVERNANCE OF WATER SERVICES IN MUKURU

5.1 INTRODUCTION

This chapter substantiates the modes of negotiation and engagement employed by actors in the access, use and disposal of water services in Mukuru bearing in mind that the Mukuru case dominates the study given the relatively high number of actors and the complexity of their interactions. The case demonstrates how multiple layers of governance linked to diverse actors with deeply entwined set of interactions impact on service delivery. This chapter addresses the sub-question: Who are the key actors, their roles and practices in water services in informal settlements? Based on the everyday micronarratives the reactions of specific actors and how they influence the behavior of the other actors will be revealed. Micronarratives capture the realities on the ground and show which actors benefit from various interactions. Based on their affiliation to the state, the chapter classifies actors either as state or non-state actors.

By examining state actors in Mukuru, the complex layers of bureaucracy will be revealed as well as the intersections of both state and non-state actors. Exploring non-state actors in particular will foreground the idea that reducing governance to dominance would overlook the diffusion of power and human agency in devising alternative ways of accessing water services. As will be shown, the Mukuru case demonstrates an inversion in the understanding of the governance process and the relationship between the state and the citizens because the actors who have knowledge of the infrastructure control water services and the state depends on this knowledge to predict where and how the water will flow. The case thus demonstrates non-normative modes of governance whereby top-down written rules on governance are rendered to be discretionary and opens spaces for actors to maneuver through in order to gain access to water services which would otherwise have been inaccessible on the basis of rules-based mode of governance.

The chapter also foregrounds the idea of *people-as-infrastructure* by highlighting the role of social relations and the human body in access to water services. Moreover, examining the social differences that configure access and control of water services by the different gender generated a nuanced understanding of the governance process. This is significant because the rules and norms of access to resources may limit the agency of men and women in water services governance (Cleaver and Hamada, 2010). Additionally, water

access in informal settlements is a physical activity that requires a human body to ferry it from the source to the house. An enquiry into whether it is the female or male body that ferries the water could give a better understanding of the water service governance. The focus on the gender dimension thus reveals how social dynamics influence governance processes as well as showing areas where there may be symbolic inclusion but material exclusion of the different gender.

Equally, this chapter will argue that the practices of water access are dependent on the fluid understandings and meanings attached to water by various actors (Linton, 2010). In other words, how do the different significations of water affect the practices for water access? Water is not just a material product but instead also constitutes the outcome of social processes as well as practices. Thus, every encounter with water is imbued with ideas, views and meanings that people have conferred on it. Moreover, thinking about water solely from a materiality perspective may obscure significant issues about its governance. The practices by different actors in water access together make up the politics of water access (Peloso, 2014). This idea is succinctly summarised by Linton's argument that "water is what we make of it" (Linton, 2010:3). Linton further argues that the global water crisis has been framed in terms of pollution and scarcity thereby leading to solutions that focus on the technical and hydrological aspects.

Addressing the water crisis adequately therefore requires broadening the single understanding of water as a physical resource. Previous debates around water scarcity focused solely on the physical dimension which usually "evacuate the social content" of water (ibid.: 2010:22). Consequently, water should not be viewed as an isolated resource detached from social processes and outcomes (Peloso, 2014). The discussions in this chapter therefore examines the different attributes and connotations given to water and how they shape responsive practices and governance of water services.

The chapter begins by identifying as well as categorizing state versus non-state actors coupled with an elaboration of their roles and interactions in water services. In presenting the actors, the strength of the linkages between the actors is highlighted as well as the nature of the relations and associations between them. The second and third sub-questions help the study to present the actors and their practices in water services in Mukuru. The data presentation and analyses for the sub-questions therefore take a relatively descriptive approach where the direct observations (primarily through transect walks and direct observation)

and interviews and FDGs responses as well as secondary data are systematically woven into the narration. In view of the above, the approach to data coding and analyses is shown in Table 5.1.

5.2 ACTORS IN WATER SERVICES IN MUKURU

As discussed in depth in Section 4.3.2, the roles and responsibilities for the provision of water services in Kenya are distributed across multiple state agencies, non-state actors (including informal services providers) and NGOs/CBOs. Further, there is a dual system of governance of water which covers water services delivery and water resources management functions (Rampa, 2011). This separation makes water governance highly complex given the high number of state and non-state actors with unequal power and interests as well as their motivation (Mumma, 2008). Figure 5.1 is a diagrammatic representation of the state and non-state actors in water resources management and water services delivery that resulted from the Water Act 2002 and the 2016 water sector reforms in Kenya (WRG, 2016). Besides, the diagram indicates the levels of government related to the various institutions. A more comprehensive capture of the data on actors and their practices is presented in Appendix 7 which is regularly cross-referenced in the analysis sections of this chapter.

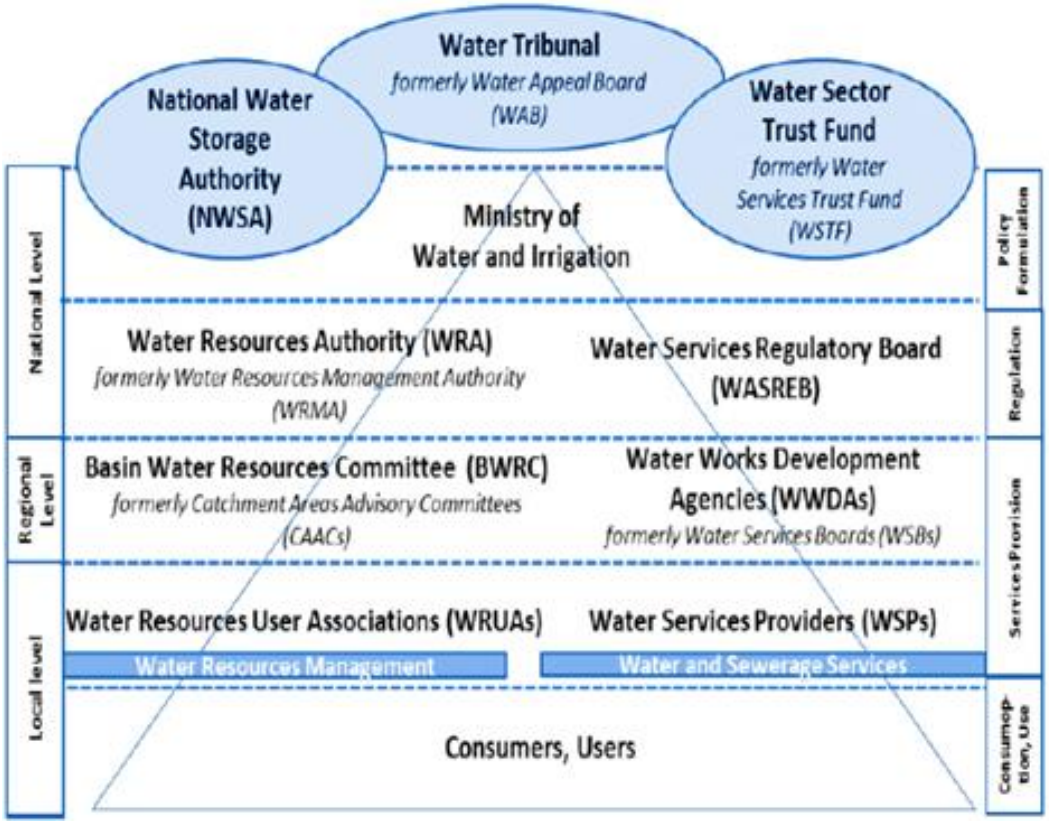

Figure 5.1: State and non-state actors in the Kenyan water sector governance (Source: WRG, 2016,: Unpaginated

Table 5.1: The actors, their roles and practices in water services in Mukuru

Major data themes and sub-themes		**Data sources & instrument: Primary and Secondary data**			
Major Themes	**Sub-themes**	**Focus group discussions and Semi-structured interviews**	**Key informant interviews**	**Transect walks and direct observation**	**Secondary sources**
State actors	National level: Roles and practices	National government -Implementation of the constitution. -Universal access to water services.	WASREB, WWDAs Levels of state actors: national, regional or local -Licensing, coordinating and monitoring WSPs. -WASREB is the national regulator of water services	No observation	Levels of state actors: national, regional or local -WASREB (2010) The national regulator of water services -WWDAs instal and maintain hydraulic infrastructure -The different layers of regulation and distribution of governance of water services.
	Regional level: Roles and practices	CGN -Owns NWC -Oversees supply of water services to Nairobi -NWSC water utility Distributes water to residents in Nairobi.	CGN -The evolution of NWSC. -The challenges faced in monitoring NWSC. -NWSC The roles are mandated in the constitution.	NWSC satellite offices located in the settlement.	Davis, Crow and Miles (2012) -The installation of chambers in the settlement by NWSC.
	Local (community) level	Chiefs, Local administrative officials and police	Local administrative officials and police.	NWSC employee taking meter readings	-Davis, Crow and Miles (2012) -Rampa (2011)

	Roles and practices	-Facilitate and inhibit service provision -Land allocation and evictions.	-The role of the police in enhancing law and order in the settlement. -Corrupt practices by chiefs and local police.		
	Practices for granting and maintaining access.	Installation of NWSC chambers, pipes and PPDs	NWSC installs water chambers, pipes and PPDs	Photographs of water chambers and pipes	Crow and Odaba (2008)
		-Monthly bills are received. -State officials see the connections but ignore them.	-Monthly bills sent to residents -Offline billing system -Outstanding bills of senior managers at NWSC. State officials do nothing to wrongdoers.	Spaghetti connections running in the settlement.	-Berk and Galvan (2013) political creativity. -Benevides (1995) Role of silence in the water scarcity narrative.
	Practices for denial of access	-State officials demand bribes not to disconnect -Residents unaware of the rationing schedules -Lack of data bundles to access schedules	-Disconnections due to non-payment of bills and bypass connections -NWSC prepares the rationing schedule.	-Illegal connections -Pipes not producing water	-Misra (2014) Suspension of formal rules to allow for manoeuvre. -Bjorkman (2014) rationing programmes in Mumbai India
Non-state actors					
	Water vendors	-Development and typologies. -Application for a water connection from NWSC	-Large scale water vendors -Small scale vendors	-Water points throughout the settlement.	-Obada and Crow (2008) study in Kibera slum, Nairobi. -Mutinda and Otieno (2015) study Mukuru

					-Ahlers et al (2014) Infrastructural violence
	Water vendors' practices for gaining access	Real and tactical compliance but pumps are illegal.	-Formal application process for meter connection	-Spaghetti pipe connections see Figure 4.5	-Sverdlik (2017) study Mukuru pre-announced inspections by NWSC.
		Bribes paid to stop confiscation	Money is collected from water vendors for bribes	A resident pointed out a chamber chairman during a transect walk.	Sverdlik (2017) study Mukuru: vote banks not created through service provision
		Negotiate for connection from cartels	The human face of NWSC	A resident in the NWSC pleading her case with an official.	Chatterjee (2004) political/civil binary
		-Pilferage from fellow vendors -Disconnect other vendors connection	Fights erupt between vendors over stealing of water	T- junction pipes for making diversions	Crow and Odaba (2008) Cartels in Nairobi
		-Water is life, water is death. -Ethnic diversity inhibits protests	Protests by the residents over prolonged shortage	Media reports on protests in Mukuru	Bayat (2010) war of attrition
	Practices for maintaining access	-Repairs -Collusion with NWSC officials	-Delayed repairs by NWSC	Pictures of colour coded and joined pipes	Anand (2015) hydraulic infrastructure repairs in Mumbai
	Non-governmental organizations, community based organizations and self-help groups.	-PPDs are sabotaged. -Challenges of PPDs. -NGOs support CBOs and SHGs.	-Role of NGOs and CBOs	-Photos of dysfunctional ablution blocks operated by CBO and SHG see Figures 5.5. and 5.6	Peloso (2014) Accra, Ghana.

	Mukuru community	Participatory governance The diversity of meanings of water Basic services provided by certain ethnic groups.	'Water is death in Mukuru'	I attended community meetings.	-AMT et al. (2015) Community participation -Weru et al. (2014): Community participation -Linton (2010): Meaning of water
	Gender dynamics	-The involvement of women in the water business. -Women carry the responsibility of procuring water	Women bear the burden of intermittent water supply	-The predominance of women on the water queues. -Women carrying jerricans of water.	-Anand (2017): rationing schedule produce a gendered body- female -Davis et al. (2012) average time women take to procure water.
	Practices of residents for gaining and maintaining water services	Residents use greywater to flush toilets. Reusing and recycling wastewater	Wastewater for urban agriculture	-Large bucket with grey water outside people's houses. -Foul smelling wastewater.	Eklund and Tegelberg (2010) Gallaher et al. (2013) Risks of recycling water Mc Granahan (2002).
		-Storage in kegs or jerricans. -Size of house restricts storage.	-Ensuring that water is always available due to uncertainty.	-Yellow jerricans inside and outside the houses.	Water storage: Peloso (2014); Accra, Ghana
		-Behavioural coping practices Postponing non-urgent activities. -Paying for water-related services	-Children sent to rural areas in severe water shortages.	-People showering in the ablution blocks.	-Mc Granahan (2002) The adverse effects of behavioural coping mechanisms
		-Borrowing from networks/water gifting -Getting water from relatives nearby and neighbours.	-Getting water from relatives nearby and neighbours	No observation	-Xali (2002) Khayelitsha -Zug (2014):economic, spatial and social elements of water gifts. -Zug and Graefe (2014)

		-Borrow money to buy water. -Send children to borrow water.			
		-Social networks -Neighbours and friends communicate about water availability.	Knocking doors to announce the return of water.	Media reports on protests.	Auyero (2014) waiting time on the queue
		-Abandoning meters -High bills leads to abandoning meters.	Families opening several accounts	No observation	Peloso(2014) Perceptions to water billing systems.
	Denial of access	-Conversion of hydraulic infrastructure for commercial purposes	-Distribution of income from converted infrastructure.	-Ablution block used as chicken pens Figure 5.9 -Water kiosks used as kindergarten Figure 5.10	-

5.3 STATE ACTORS

The 2010 Constitution of Kenya promulgated that access to safe and adequate water constitutes a basic human right while also placing the responsibility of delivering water services to citizens on the county governments (see Section 4.3) (Government of Kenya, 2010). State actors in the provision of water services are governments or related agencies owned, and directly or indirectly funded by or affiliated to the government. State actors also include government officials at all levels of the hierarchy. A key argument in this study is that infrastructure mediates the diverse interactions between the state and the residents towards ensuring access to water services, and through infrastructure, that the state renders the various actors visible. Infrastructure could therefore be regarded as a power-tool for the state to exercise dominion and as a source of power for the state (Meehan, 2014). In the case of Mukuru, state actors are charged with the provision and maintenance of the water services infrastructure. The main state actors include Water Services Regulatory Board (WASREB) and Water Works Development Agencies (WWDAs), the County Government of Nairobi (CGN), Nairobi Water and Sewerage Company (NWSC) as well as the local administrative officials and police (see discussions in Section 4.3.2). The next Section elaborates on the role of local administrative officials and police as well as their practices in water governance.

5.3.1 Local Administrative Officials and the Police

This category of state actors comprises chiefs, their assistants and the police who are responsible for maintaining law and order in the settlement. The chiefs and assistant chiefs are engaged in service provision and resource allocation discussions such as land sale or evictions (see Sections 4.2.1 and 4.2.2). The residents enlist the services of chiefs on matters such as the issuance of proof of residency which is required for the application for a metered connection. Interview responses from water vendors revealed differing experiences with chiefs in accessing services from them. A water vendor reported that, “chiefs collect 100 Kshs. (1 USD) from every water point in the settlement, they really eat!” (Personal communication, community leader 1, 23-08-18). However other resident claimed that “ yes chiefs are corrupt and controlled by the cartels but they help us solve some of our problems” (Resident, Mukuru FGD 2, 20-10-18).

Police officers are assigned to maintain law and order as well as to address security concerns in the settlement. The police also execute the decisions taken by the chiefs or their assistants. For instance, they are mandated with ensuring that evictions of tenants are carried out as peacefully as possible without

protests. During the FGD, residents intimated that the police quash resistance from residents (Resident, Mukuru FGD 1, 26-08-18). Residents and water vendors disclosed that access to water services often required them to pay bribes to the police. Interview responses by residents showed that water cartels bribe the police to turn a blind eye to illegal practices such as installation of pipe extensions or pumping water using illegally connected electricity. Further, residents revealed that although water cartels paid bribes to police, the bribes did not yield any return unlike when they paid the utility as the payment led to more rapid resolution of power failure or infrastructure replacement. In the FGD, a water vendor disclosed that "although the amount paid to the police is low, we pay it frequently depending on what one is caught doing" (ibid.). Additionally, in the same FGD the residents disclosed that state officials negotiated among themselves on when to release an arrested water vendor or a confiscated pump stating that " NWSC negotiates the bribe with vendors and share with the chiefs and the police" (ibid.). Thus, although the police were supposed to report infractions in the settlements, the bribes significantly hindered the fulfilment of their duties.

Under normative mode of governance, the police should provide security services to all but the residents do not rely on them because they perceive the role of the system as that of allowing transgression of the law through noninterference once transgressors pay the bribe. During the FGD, the residents intimated that "water vendors need alternative plans including employing private security guards at night to ensure that illegal connections are not made from their pipes" (Mukuru FGD 2, 20-10-18). Further, residents revealed the reason for their mistrust of the police stating that, "during severe water shortage, hand cart pushers employed by cartels sell water in front of the police post and no one questions it" (Mukuru FGD 2, 20-10-18). Further details on factors leading to the dominance of cartels are presented in Section 4.4.

5.3.2 State Practices

State practices encapsulate state operations and the impact of such operations in configuring urban spaces as well as the governance processes. The practices include those of WASREB, WWDAs, the CGN and the NWSC as well as the local administrative officials and police. As shown in Table 5.1, state practices are analysed under two categories namely: practices for granting and maintaining access and practices for denying access.

5.3.2.1 Practices for granting and maintaining access

Installing and maintenance of infrastructure

NWSC installs the infrastructure required for the provision of water services, specifically water chambers and PPDs at strategic points in the settlement. In a bid to counter the takeover of the chambers by cartels, NWSC installed an overland (on the surface) visible pipes to make all the connections on the pipe visible. This was aimed at mitigating vandalism of the water pipes as well as reducing illegal connections which are largely executed through underground pipes. However, the installation of the pipes was contested by politicians and the cartels. An interview response by an NWSC official indicated that "the councillor claimed that he had allocated the installation of the pipes in his budget and so he should do it" (Personal communication state official 5, 26-08-18). A community leader elaborated that "the cartels saw the pipe as a threat to their business and burnt it" (Personal communication, community leader 1, 23-08-18) (see Figure 5.2). Another NWSC official expressed his frustration saying that "when the cartels burnt the pipe, which was quite expensive we abandoned the project" (Personal communication, NWSC official 1, 20-08-18).



Figure 5.2: The remnant of the burnt overland pipes in Section 48

Given that the water pipes are punctured in order to make illegal connections, the NWSC carries out frequent repairs of the infrastructure to maintain access to water services. Previously, the company faced significant resistance in repair and maintenance from water vendors who perceived the presence of company engineers

as a threat to their illegal connections. However, negotiations between the residents, cartels and NWSC changed the perception as elaborated by an official; “they now see the usefulness of the technical people since repairing the pipes means that they can continue stealing water” (Personal communication, NWSC official 7, 20-08-18). The findings indicate that state-controlled water supply systems are crucial for providing water services to the marginalized even though they translate into illegal connections to ensure continued flow at points of access.

Billing

Through billing NWSC maintains supply of water services to the residents who honour their bills. Monthly bills are sent out to water vendors and CBOs that run water projects based on their consumption. Some residents who have large outstanding bills negotiate a payment plan with the NWSC officials. Box 5.1 presents my observations of negotiations between a NWSC official with a water vendor on a water bill. In an interview, a NWSC official explained that “we understand the challenges of life so when a vendor makes a compelling case we make an instalment plan offline system for audit purposes...” (Personal communication, State official 7, 20-08-18). This finding suggests “stateactor-discretion” at the coal-face (point-of-access) which suspends the rules to create room for other tactics which guide response and action.

Box 5.1: Excerpts from field notes on 20-08-19

During the interview with official 7, a water vendor walked with a water bill. The official excused himself and went over to her and she began to explain that she was widowed and the breadwinner for the family; that the water business is her only source of income; that she wanted to pay in instalments. The official proposed Kshs. 3,000 monthly instalments but she said that she could afford Kshs. 2,000. Finally, the official gave in. He printed the instalment plan and receipt for the Kshs. 2,000 offline as the company does not allow instalments of less than Kshs. 3,000. When the water vendor left, he explained that ‘dealing with human beings is hard because you have a heart!’.

Silence and inaction

A state official intimated that some of the NWSC senior management who own structures or tenements in the settlement had the highest outstanding bills. Upon probing, the official explained that "they provide water to their tenants so I cannot disconnect because they are top managers" (Personal communication, NWSC official 1, 20-08-18). In another interview a middle-level official disclosed that "a senior manager asked me to stop following up specific outstanding accounts" (Personal communication, NWSC official 4, 23-08-18). This same official continued to elaborate that "it is peculiar that when meter readers are involved in corrupt deals they are dismissed but top-level managers are rarely charged" (ibid.). This statement indicated the dilemma that some of the middle-level officials face when dealing with both top and lower-level officials. Equally, the lower-level officials disclosed that their silence and compliance with unlawful requests from politicians or high-ranking state officials was out of the fear of job changes or transfers. The practices of inaction and silence reveal the contradictions within the state through selective visibility whereby state officials highlight and silence some points depending on the willingness and ability of the state to address them as well as the personal interests of some officials in line with discussions on the politics of invisibility by Razon (2017) in Section 2.4.

Besides, through billing and silence/inaction, individual agency of state officials in relation to structure through and from their practices can be understood. The rules that govern NWSC operations structure and constrain the behaviour of the officials but by employing tactics such as improvising, side-lining, breaking and creating rules, the officials are able to subvert the system thus rendering it fluid and malleable. Documentary review showed that political creativity contests the duality of structure and agency to embrace situations where order and change are intricately linked and state officials are not necessarily constrained by the rules or act in opposition with the state (Berk and Galvan, 2013). Besides, institutions are path dependent entities with "partial and multiple" actors who can "dismantle orders, select useful parts to combine them in new ways" (ibid.:8). Further documentary evidence shows that silence is part of the story that is told and constantly (re)produced and managed, thus silence is an integral part of the narrative of how we understand water access (Benevides, 1995). Equally, the role of politics in water access is often silenced in order to make the water scarcity narrative dominant and powerful and to justify social inequality (ibid).

5.3.2.2 Practices of denial of access

NWSC disconnects water supply due to non-payment of bills and the installation of bypass connections to divert water from the main pipe while circumventing the meter. In the case of default payments, a fourteen-day warning of the impending disconnection is issued to the resident. The company policy stipulates that if the customer does not make the payment within the stated time then the meter is disconnected. In an interview, a state official explained that disconnection of water was a measure of last resort because "it is hard to disconnect the water for people living in these deplorable conditions!" (Personal communication, NWSC official 1, 20-08-18). Another NWSC official indicated that "when you disconnect water you have cholera outbreaks and the residents protest on the streets so disconnection is the last resort" (Personal communication, NWSC official 5, 26-08-18). The other reason for reluctance to disconnect water is that the water vendors reconnect the water illegally thus making it an exercise in futility. A frustrated official shared the arising sense of disempowerment "we disconnect the water during the day and the cartels reconnect it that same night" (Personal communication, NWSC official 7, 26-08-18). Hence, the state officials on the ground not only require knowledge of the connections and valves but also know how to negotiate with the residents during disconnections and reconnections of water supply.

Moreover, disconnections were viewed as a stimulus for illegal connections. A NWSC official revealed that "… the bills are unaffordable for the residents, so they make illegal connections to access water" (Personal communication, NWSC official 5, 26-08-18). Besides, disconnections are an avenue for 'on-the-ground' officials to extort money from the customers seeking to reconnect the water supply. A water vendor put it this way, "when water is disconnected, the chamber chairman collects money to bribe the officials to reconnect it" (Personal communication, water vendor 8, 23-08-18) (also see Section 4.2.1). Hence, disconnection reveals different rationalities and contradictions in the state because while the top-level officials do not support disconnection in practice, the lower level officials view it as a way of generating extra income on the side.

Furthermore, a water vendor revealed that, "a meter bypass is a criminal offence and so when discovered, the connection is severed immediately" (Personal communication, water vendor 3, 15-10-18). When a bypass is enclosed in a building and is inaccessible for the NWSC officials, draconian measures such as blocking the sewer line into the building are employed to stimulate a quick response. A NWSC official explained that "blocking the sewer produces a quick response because the inconvenience is unbearable" (Personal

communication, state official 4, 21-08-18). Although the practice of blocking the sewer line is not stipulated in the company policy, it is used by the "state actor" on the ground as a measure of last resort. A similar context in Bhubaneswar, India, reveals that informality was nested on formality in such a way that the formality of service delivery appeared intact while the legally defined procedures were suspended to create room for manoeuvre and flexibility (Misra, 2014). The findings thus corroborate the scenario in Mukuru where the state officials subvert and invent rules for pragmatic reasons aimed at ensuring access.

In an interview a NWSC official reported the use of temporary disconnection of water services to attain the immediate attention of residents and water vendors. A state official intimated that:

> "…previously, we utilized posters to call for meetings to no avail. As water is their source of livelihood, turning off all the valves at the chamber brings the vendors to the chamber in ten minutes! They are attentive and keep the discussions brief to resume their business quickly (Personal communication, state official 7, 22-08-18).

I argue that by turning off the valves at the chamber the state alternatively communicates with the water vendors thus demonstrating how control over material infrastructure gives the state power to accomplish its objectives. Further, this hard communication approach (whereby water vendors have no option but to comply with the state's demands) opens unequal spaces for continuous compromise and negotiations between NWSC officials, the water vendors and the residents in which NWSC is the dominant player. Besides, the double-edged role of infrastructure is evidenced in that the same chamber is used for progressive purposes in providing water to the residents and is employed for repressive and oppressive purposes to make them respond in a particular way.

Furthermore, the water rationing programme aimed at equitable water distribution in the city entails disconnections. In an interview a water vendor complained that, "the schedule is a mere formality because it is haphazard and unreliable" (Personal communication, water vendor 8, 23-08-18). Moreover, the rationing schedules are often inaccessible given that they depend on internet access and maybe unintelligible to people living in informal settlements. A water vendor elaborated that "…you need data bundles which are expensive to access the schedule" (Personal communication, water vendor 8, 23-08-18). Hence water rationing adversely affected the residents due to limited coping options and unreliable rationing schedules.

However, NWSC has adopted soft power approach in which "instead of stopping their livelihood, we legalize the illegal by encouraging them to apply for meters" (Personal communication, NWSC official 4, 21-08-18).

5.4 NON-STATE ACTORS

This category comprises individuals or organizations who are not affiliated to the state but exercise influence on the state actors in varying degrees. Non-state actors make significant contribution in provision of water services in underserved areas where the state actors are unable to reach. The non-state actors are analysed in three broad categories as presented in Table 5.1:

- Water vendors; Large-scale water vendors and small-scale water vendors
- Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and Self-Help Groups (SHG)
- Mukuru residents: Mukuru community; Gender dynamics

5.4.1 Water Vendors

Given the design of water chambers, the presence of water vendors in Mukuru is inevitable for the last mile delivery process since the majority of the residents cannot afford a metered connection. Based on a literature review of the role of small-scale private service providers in Kenya, Kariuki and Schwarz (2005) found that water vendors play three key roles; as "gap fillers" who distribute the services to areas where the utility cannot reach; "pioneers" to deliver water to areas without infrastructure and established water systems; and "sub-concessionaries" who act as middlemen between the company and the residents. They further argue that water vendors are heterogeneous, unregulated and depend on the state for their business operations. In this study, the water vendors have been classified either as large scale or small-scale vendors based on the volume of water sold, the power that they wield and the number of water points that they have. Typically, the large-scale water vendors sell large volumes of water to both end-users and other small-scale vendors who then resell it to end-users.

Large Scale Water Vendors

Section 4.4 presented analyses on large-scale water vendors (referred to as cartels in this study) and the typologies of cartels in Mukuru. Cartels proliferated after the construction of water chambers on the periphery of the settlement which required residents to apply for meter connections from the chamber to their houses.

In an interview, a NWSC official intimated that initially the NWSC was apprehensive about providing services to informal settlements as this could be misconstrued as legitimizing the settlements. However, frequent disease outbreaks in the settlement led the company to seek alternative ways of providing water services. Interview responses from a NWSC official revealed that "the cost of making a connection was prohibitive for the majority of the residents of Mukuru and this led to a market gap that attracted cartels who can afford the initial cash outlay. The cartels seized control of the water services in the settlement" (Personal communication, NWSC official 5, 26-08-18). Given that the provision of water services is unregulated in Mukuru, the cartels have taken over the delivery of services by adopting state-like operations.

Based on their study of water services in Kibera informal settlement in Nairobi, Kenya, Odaba and Crow (2008) note that cartels are a type of public-private 'partnership' formed by public officials and private investors who collude to inhibit competition and public accountability. This 'partnership' (in this case, between water vendors, NWSC officials and the police) leads to a blurring of the state-society boundary. Documentary evidence shows that public authority is shared with several twilight institutions who work towards gaining legitimacy by mimicking state like features whilst simultaneously undermining the state. Moreover, such institutions are continuously in flux, fading in and out of power and operating between public and private, legal and illegal, and thus in the twilight between state and society, thereby making their features hard to clearly distinguish. This falls in alignment with Lund's (2006) discussions on public authority as reviewed in Section 2.5.

Small Scale Water Vendors

These are vendors who get a connection from the NWSC chambers to sell water to the residents, the majority of whom live in the settlement. In order to install piped-water the residents apply for a meter from the water utility company. A water vendor elaborated on the process of getting a connection stating that "one has to submit a duly filled application form from the water utility, Personal Identification Number (PIN) certificate, the requisite fees of Kshs. 7,500 (75 USD) and proof of residency from the local chief" (Personal communication, water vendor 7, 26-08-18). After submission, the applicant gets a reference number. Ideally, if due process has been followed, the utility makes a connection to the main pipe in two weeks. Another water vendor explained that "usually there are delays and it takes about 3 years to get the connection approved and by this time the utility might even ask the applicant to make a fresh application because the file is likely to be missing" (Personal communication, water vendor 4, 27-08-18). In study of service provision in Buenos Aires,

Argentina Auyero (2012) found that the poor must endure the 'wait' to obtain services from the state. Further, waiting is a significant part of poor people's experience with the state because during the wait the rules and requirements change, timelines shift, and the poor are often taken around in circles (ibid.).

An in-depth understanding of the emerging power-relations findings suggest that the 'missing file' is probably an intentional delay tactic meant to frustrate the applicant so that he gives up applying for water from the company and looks for alternative sources. Another avenue for access would be through negotiation for a connection with someone who already has a connection at the chamber for a monthly fee. Therefore, although officially there is one connection at the water chamber, in reality, there could be many water points emanating from a single connection due to illegal connections which are an important means of accessing water without resisting (AMT et al., 2015). However, the main alternative is to get a connection from the water cartels. Additionally, the residents expressed their keenness on getting a legal connection since it promises more than water delivery as it also provides a form of recognition by the state and can be used to claim tenure in future.

Obtaining a connection entails making a once off payment of Kshs. 40,000 (USD 400) to the cartel for the 'expression of interest'. Additionally, the vendor has to buy connection pipes (which sometimes could be up to 1 km) depending on the distance to a reliable water point and pay labor fees for the people (usually the youth) digging the trench for the pipe network. A pump is often necessary to increase the pressure of water from the source to the water supply point. Documentary review suggests that the payback period to recover the initial capital outlay in the water business in Mukuru can be as low as four months (Mutinda and Otieno, 2015). Thus, the majority of the small-scale water vendors have two sources of water; the legal meter from the water company and an illegal connection from the cartels which is a form of infrastructural violence which entails creative and innovative ways of adjusting or altering infrastructure to contest or exploit infrastructural inequality (Ahlers et al., 2014). Hence illegal connections provide a source of livelihood for water vendors while limiting their engagement with the state since they remain undocumented. Moreover, these unregulated water flows structure the everyday lives of both the residents and water vendors. Additionally, illegal connections produce varied forms of knowledge and ignorance of the settlement's hydraulic infrastructure.

The discussions reveal that while small-scale vendors had weak loyalties with their anonymous and somewhat invisible customers, such vendors are known to the cartels and are expected to remain loyal

through buying from the cartel member designated to their region. Besides, given that these vendors experience the realities of living in the settlements, they are aware of the hardships and struggles of particular households leading them to be sympathetic and adopt social-welfare principles in their water business practices. A water vendor explained that, "I sometimes give free water to orphans, the disabled and the elderly" (Personal communication, water vendor 4, 27-08-18). Thus, the operations of these vendors are multifaceted and complex ranging from colluding with state officials, oppressing households and showing sympathy to the weakest.

5.4.2 Water Vendor Practices

In addition to serving as coping mechanisms, water vendor practices are critical in curtailing the power of state officials by influencing how the system functions. As shown in Table 5.1 these practices are analysed under three major themes; practices to gain access, maintain access and deny access.

5.4.2.1 Practices for gaining water access

The practices for gaining access will be discussed in this subsection:

- Real and tactical compliance
- Mediation
- Negotiation
- Pilferage from fellow vendors
- Resistance

Real and tactical compliance

Most of the water vendors have two sources of water at the same time: the legal meter from NWSC and the illegal connection from the cartels. On the surface of it, the small-scale vendors seem to comply with the prescripts and rules of NWSC by applying for a metered connection but in reality, they break the law as they get water through illegal connections. Through collusion with NWSC officials, the water vendors are warned about impending inspections so that they can remove the connections temporarily. In addition to the initial cost of investment, there are incidental costs such as fees paid by vendors to the NWSC officials to avoid 'confiscation' of pumps during inspections. In an interview, a water vendor explained that "…pumps are illegal so (...) if confiscated one has to pay money to get them back from NWSC officials" (Personal communication, water vendor 1, 21-08-18). However, though the inspections were high-tension moments,

water vendors have become acquainted and forged relations with the utility officials. A water vendor explained that "we get to know them during the inspections as conversations start when they seek information or clarifications about issues" (Personal communication, water vendor 5, 20-08-18).

The dual connections are deemed useful to cope with intermittent water supply since the utility regularly rations water thus necessitating multiple sources of water. This demonstrates coexistence of practices on real compliance and tactical compliance among vendors. Real compliance occurs when water vendors apply for and get connected to a meter from NWSC whereas tactical compliance entails giving an impression of adherence to the prescripts of the water utility while in reality the vendors flaunt the rules by operating on the basis of illegal connections. Moreover, the application papers form the basis for negotiating with the NWSC officials in case of arrests. The tactical compliance consists of trappings of formality that are employed by water vendors to legalize their operations and to avoid trouble with the state officials. The finding is in consonance with Bayat (2010:24) idea of "war of attrition" which entails short term adherence to the rules during times of restrictions while encroaching on the same rules as the need and/or opportunity arises. Thus, the continuous creation of conflictual and amicable relations whereby residents adapt formal rules as they navigate life in the urban margins is a form of quiet encroachment (ibid.). Further, real and tactical compliance reveal the constant and fluid intersections between formal actors and informality.

Mediation

The practice of mediation manifests through a combination of intermediaries that comprise people and material objects. The chamber cartels access water services through the intervention of the chairman who presents their grievances and the money collected from the vendors to give to the NWSC officials to accelerate problem resolution (see Section 5.4.1.1). Moreover, the chairman is entrusted with the key of the chamber to sort out some problems at the chamber when the company officials are unavailable (see Figure 4.5 and Section 4.4.1). The interactions between the NWSC officials gives the chairman legitimacy and public authority as he fades in and out of power depending on the role he is playing. However, an interview with a NWSC official revealed that the chairman of the chamber cartel did not always work in the interest of the other cartel members. He explained that, "...these people are thugs who collect money from members but keep it for themselves" (Personal communication, State official 7, 20-08-18).

Interview responses from water vendors showed that they did not rely on local politicians or administrative officials to access water services. A water vendor said that "…politicians come looking for votes and make promises but nothing happens afterwards" (...) and "…and you have to bribe the chiefs to get help" (Personal communication, water vendor 5, 20-08-18). The lack of involvement by local politicians in service provision could suggest that they do not consider provision of services a vote-bank strategy. From the aforementioned, it seems that the residents have learned that the promises made during the election campaigns are only meant to convince them to vote for the politician and that although state actors are involved in the supplemented model of service delivery, local politicians are less involved.

Negotiation

Negotiation becomes important in securing a connection from the cartels. However, a pipe connection does not mean that the tap will produce water. Ongoing negotiations between the state officials, the cartels and the water vendors are needed to ensure continuous flow of water through the pipes. Individual cartel members are known in the settlement because the majority of them live in the settlement. However, water vendors who obtain a connection from other legally connected water vendors reduce their interactions and negotiations with NWSC officials. One such water vendor indicated that "…although I do not deal directly with the NWSC people, I have to bargain prices with the person who has given me the connection" (Personal communication, water vendor 1, 22-08-18). In line with Chatterjee (2004) political/civil society dichotomy in Section 2.5, ongoing negotiation is an important 'weapon' for water vendors to seek exceptions to the rules in order to sustain access to water services. Chatterjee's argument is based on the fact that since residents of informal settlements (political society) occupy illegal land, they are excluded from rights-based claims and have to depend on negotiations with state officials and cartels in order to access resources. These findings indicate that although universal access to water services is a constitutionally given right in Kenya, in practice the residents of informal settlements are excluded through inadequate infrastructure. The practices of negotiation blur the line between the political and civil societies since rules can be a source of power either through their application or evasion.

Pilferage from fellow vendors

I observed that pilferage in Mukuru entails either installing a T-pipe joint to tap into a cartel's connection by creating a diversion for the water or blocking the pipe with a piece of sponge or a piece of maize cob to stop water flowing to another vendor's water point. It amounts to stealing illegal water from another vendor thus

paralyzing their business. As most of the illegal disconnections and the blocking of pipes usually take place at night, water vendors employ security guards to ensure that unsolicited connections or disconnections are not made (see Section 5.2.1). Pilferage of water was a common cause of conflict between water vendors in Mukuru. A water vendor explained that, "when there is an abrupt reduction in pressure, I track the pipe and cut it at different points to find the cause of the problem which may take upto 2 weeks. Once I find the culprit, a confrontation ensues and may sometimes culminate in a physical fight" (Personal communication, Water vendor 2, 25-08-18). In another interview, a water vendor revealed the reason why vendors pilferaged water saying that "people cut my pipe to stop competition and out of envy but when I discover I fight back" (Personal communication, water vendor 5, 19-08-18). Thus, the pilferage of resources is a survival tactic for accessing services at the expense of fellow vendors which often results in water related conflict.

Resistance

Although water vendors in Mukuru employ resistance and protests as modes of accessing water services in the settlement the practice is not prevalent due to fear of the consequences of resistance. Thus, vendors refrain from open manifestations of resistance. A water vendor explained that, "(…) as they know us and threaten us (...) when threatened we lie low (…) I use different routes to my house to avert a possible attack. Water is life, but in this settlement, water is also death" (Personal communication, water vendor 6, 20-08-18). Besides, the heterogeneous ethnic composition of the settlement makes it difficult for water vendors to resist the cartels (see Section 4.2.1). A water vendor disclosed that "…ethnic diversity makes it hard to organize protests as we do not speak the same language" (Personal communication, water vendor 1, 22-08-18). However, in the past, water vendors united to resist harassment by company meter readers at the chambers. A state official stated that "previously water vendors protested that meter readers extorted bribes from them and disconnected water for no reason but after a lot of negotiations and engagement, the relationship is now amicable" (Personal communication, state official 7, 20-08-18).

Importantly, interview responses revealed that water vendors are indifferent to the situation and in a sense apathetic. Given that their main priority is access to water services for resale, they are resigned to the fact that the cartels will continue to dominate water services delivery. Thus, water vendors in Mukuru do not rely on resistance as a means of access to water services. These findings are in line with Bayat's (2010) findings as reviewed in Section 2.4 where through the politics of social non-movement, the poor can access basic services through practice and direct action and not necessarily through protests Further, the findings are

similar to those of a comparative study of service provision in Mukuru and three informal settlements in South Africa, SERI (2020) where the absence of municipal services leads to unequal access to services which further reinforces vulnerability of already marginalized groups.

5.4.2.2 Maintaining access

There two practices vendors employ with regard to maintenance of water access as shown in Table 5.1:

- Repairs and
- Collusion with NWSC officials

Repairs

Based on their experience in the water business, water vendors have in-depth knowledge of the water pipes which enables them to execute repairs whenever necessary. A water vendor explained that "with time I have learnt how to repair my pipes" (Personal communication, water vendor 5, 20-08-18). I posed a question to a water vendor about how they identified their pipes, he said that "each vendor has his own colour code for the pipes at various points of the connection" (Personal communication, water vendor 1, 22-08-18) (see Figure 5.3 and Figure 5.4). From both photographs, the arrangement of the pipes is far from chaotic despite their seemingly disorganized appearance on the surface and the water vendors are able to identify their connections. As part of the negotiations with the cartels and other water vendors, the pipes are moved around as they try to make them produce water. Based on the evidence above, I argue that the apparent chaos is the product of constant and persistent changes needed to address the fluctuations in water pressure as well as social and political processes.



Figure 5.3: Color coding of pipes for identification by vendors

During the interviews I asked the NWSC officials if there was a hub where the information about the water reticulation system in Mukuru could be accessed. I wondered how knowledge about the water distribution system is produced, circulated and used. Did the NWSC officials have access to the reticulation maps and if so, how often were they updated? How was knowledge about water services produced, coproduced and reproduced in the absence of maps? The metering and maintenance staff intimated that "we rely on water vendors and residents to locate water pipes and chambers and to keep track of the history of repairs since we have no other way of knowing" (Personal communication, NWSC official 4, 24-08-18).

The staff thus depended on the fragmented and personalized knowledge among the residents to make decisions at a particular space and time. For instance, informational fragmentation makes it difficult for NWSC officials to divert water from one area to another because they lack a comprehensive view of the situation. As previously discussed in Section 5.4.2.1 the NWSC officials continuously negotiate with the residents so as to obtain knowledge of the infrastructure to implement repairs. Equally, my attempts to access the reticulation maps from the NWSC offices proved futile as the staff did not know if they exist or where to get them from. This suggests that no single actor controls the water reticulation knowledge or ignorance as each actor knows different aspects of the infrastructure, which in turn raises accountability concerns at this level. Additionally, decisions on which repairs should be executed and which ones to ignore involves negotiations for knowledge of the water reticulation with the residents as well as contestations among the NWSC staff.

Thus, repairs and maintenance of hydraulic infrastructures in the settlement are a function of knowledge and ignorance produced through various social, material and technical interactions. Hence, knowledge and ignorance of the infrastructure produce porous boundaries through which the state can negotiate with non-state actors which indicates the interconnection between knowledge-as-infrastructure and people-as-infrastructure.

Collusion with NWSC officials

Water vendors collude with NWSC officials to supply water to certain parts of the settlement while denying others with the aim of increasing demand at their water points. A water vendor disclosed that "some top officials receive monthly allowances from the cartels to cut off supply of water to other vendors" (Personal communication, NWSC 7, 20-08-18). As previously discussed in Section 5.4.1 the monthly allowances for NWSC officials was used to "get them into the system" (ibid.). This claim was corroborated in interview responses by state officials, residents and key informants. A resident complained that cartels work with NWSC officials, stating that "when we report an issue to NWSC, afterwards the cartels ask us why we reported them to NWSC" (Personal communication, resident 9, 24-09-18). Likewise, during one of the FGDs a resident reiterated that "the two work together so it is hard to complain to NWSC" (Personal communication, FGD 2, 20-10-18). Equally, in an interview a resident pointed out that "NWSC officials walk past illegal connections without questioning which means that they are in cahoots with them" (Personal communication, Resident 8, 24-09-18).



Figure 5.4: Color coded pipes at water tanks by vendors (circled in red)

5.4.3 Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and Self-Help Groups (SHGs)

In Mukuru, there are a number of NGOs involved in the provision of water services which include Kenya Integrated Water, Sanitation, and Hygiene (KIWASH), Practical Action and GOAL Ireland. The majority of them work in consortia with bilateral donors (such as the European Union (EU) and the World Bank) to construct alternative infrastructure such as water kiosks and prepaid public water dispensers (PPDs) to be operated by CBOs in the settlement. CBOs and SHGs strategically collaborate with NGOs to initiate community projects in a bid to ameliorate the water situation in the settlement and therefore are an avenue as well as platform through which collective agency can be leveraged. The participatory governance approach salient in CBOs and SHGs ensures that local communities are involved in the planning and implementation stages of the projects whereby CBOs and SHGs benefit from the financial and technical capabilities which NGOs are willing and able to provide (GWP, 2017).



Figure 5.5: Dysfunctional donor funded ablution blocks operated by CBO and SHG

The CBOs and SHGs in Mukuru provide water services mainly through ablution blocks which are a one-stop shop for potable water, showers and sanitation services (see Figure 5.5). Even though the participatory approach of the CBOs and SHGs should ensure that local communities are involved in the planning and implementation of the projects, this is not possible in Mukuru since the cartels threaten the community and sabotage their activities. The creation of SHGs and CBOs in Mukuru was a tactic for fighting the cartels but the SHGs and CBOs realized that they were dependent on the cartels who disconnected their meter connections leaving them no alternative but to procure water directly from them.

Additionally, some NGOs collaborate with CBOs in water services through installation of PPDs as shown in Figure 5.6. PPDs leverage on digital technology innovations to make water affordable and accessible through prepayments based on virtual tokens and a credit loading system which gives the residents control over their expenditure on water. Moreover, PPDs help residents to manage fluctuating cashflows given that majority of them are unemployed or have unstable jobs. The cost of water from the PPDs is Kshs. 50 cents (equivalent to 0.05 USD per 20 litre jerrican) compared to the minimum of Kshs. 5 charged by water vendors for the same or lower quantity. As the PPDs do not engage intermediaries, the cost of water is lower than that of private water vendors in addition to the convenience of the 24-hour access. During a community meeting a resident matter-of-factly stated that "token water was a strategy for fighting cartels but they are only found in few places in the settlement so we wish we also had them here" (Resident, Mukuru community meeting 1, 21-08-18). During an interview, a resident pointed out a major challenge of PPDs stating that, "topping up the virtual tokens takes 2 days for the credit to be reflected which is inconvenient" (Personal communication, resident 9, 05-09-18).

A NWSC official stated that the company had installed 11 PPDs across the settlement but at the moment only one (which is operated by a CBO) is functional (see Figure 5.6). A manager at KIWASH explained that "PPDs were installed in some areas but most are vandalized or connected to other water points" (Personal communication, KIWASH manager, 24-09-18). Additionally, although the PPDs were supposed to make water affordable to the urban poor, this came at the expense of financial viability and sustainability of the NWSC. A NWSC official stated that "PPDs are very tricky business since the CBOs that run the business get 40% of the revenue and we have not recouped the initial capital outlay" (Personal communication, NWSC official 8, 28-09-18). Given that the water from the PPDs is cheaper, I expected residents to procure water from PPDs as opposed to buying from water vendors. However, interview responses from residents revealed that they did not buy water from the PPDs due to fear of cartels. A NWSC official explained that "the cartels have resisted PPDs and they verbally and physically assault residents who buy water from them" (ibid.). Consequently, both the NWSC and the residents have not benefitted from the PPDs as anticipated.



Figure 5.6: A pre-paid water dispenser (PPD)

Moreover, I learnt that NGOs provide training for CBO and SHG members on business management principles and technical skills to carry out basic repairs. A CBO chairman disclosed that "the technical and financial training is useful but it does not include how to deal with the politics of water" (Personal communication, CBO leader 3, 1-10-18). In stating this he was alluding to the challenges faced in relation to dealing with cartels. Although the creation of SHGs and CBOs was a tactic for fighting cartels, soon the SHGs and CBOs realized that they had to depend on the same cartels for the supply of water to the ablution blocks since the cartels disconnected their meter connections (ibid.). A frustrated SHG leader narrated how "after they cut our connections, cartels only supply water for a short time but if the location is inconvenient or the distance from the kiosk is far, they cut the supply and leave you stranded" (Personal communication, SHG leader, 12-10-18). A community leader revealed that the settlement has 48 water kiosks and ablution blocks out of which 5 ablution blocks are partly operational providing only shower and toilet services. None of the water kiosks in the settlement were engaged in sale of water. When the CBOs and SHGs ceased operating the water kiosks and ablution blocks, the residents adapted them for other uses such as kindergartens and chicken pens (see further discussions in section 5.8.2).

In 2017, Muungano wa Wanavijiji (an NGO affiliated to Slum Dwellers International -SDI), conducted a situational analysis on the status quo of basic services delivery in Mukuru settlement. The project report constituted co-created knowledge (between researchers, community leaders, the residents and academicians) that anchored the decision to declare the settlement a SPA (IDRC, 2017). Therefore, co-

created knowledge and information became the basis for service delivery negotiations with the government and an infrastructure element through which the "invisible" community of Mukuru became visible to the state.



Figure 5.7: An abandoned ablution block in Riara village

In order to maintain access to water services, NGOs such as KIWASH, were working towards rehabilitating abandoned water kiosks and ablution blocks to improve the water services situation (see Figure 5.7). An interview with a KIWASH manager revealed that "we foster the sustainability of the CBO water projects though NWSC is apprehensive because CBOs start claiming ownership of chambers after rehabilitation" (Personal communication, KIWASH manager, 24-09-18). This contestation between NWSC and CBOs has delayed the rehabilitation process. Further, the same manager explained the challenge of rehabilitating the vandalised PPDs stating that "the cartels vandalised PPDs and so we have to rethink the strategy since the repairs are expensive" (ibid.).

5.4.4 Mukuru Residents

Increasingly, efforts to improve the delivery of basic services in informal settlements have acknowledged the critical need for involving communities who are the potential beneficiaries of the targeted service improvements. In congruence with discussions in Section 2.7 on coproduction, the state comes in as a partner to co-create solutions by providing technical and financial support while Mukuru communities take charge of the actualization of the solution thus rendering it sustainable. Based on the analyses in Table 5.1

this section is divided into three sections which elaborate on the role of Mukuru communities in general and the gender dynamics in the settlement in relation to governance of water services.

5.4.4.1 Mukuru Communities

As elaborated in Section 4.2.1, Mukuru residents constitute a diverse community with a heterogenous ethnic composition. Through community mobilization, NGOs have intervened in the creation of CBOs or savings groups in a bid to include residents in the governance of the settlement and to improve their livelihoods (Personal communication, MWV leader, 25-08-18). Such savings groups have been used as platforms for negotiating loans to enable the members to acquire private land elsewhere which is later subdivided among the members (ibid.). Furthermore, savings groups are useful in building social capital and provide an avenue for lobbying with the government and donor funders for community projects to improve service provision (AMT et al., 2015). Literature on participatory governance demonstrates that through training of residents by NGOs, residents' awareness of their rights has led them to resist evictions by standing up to security officers and demanding court orders thus forcing state officials to halt the demolitions (Weru et al., 2014). Although some savings groups have been organized along ethnic and religious lines, majority of the groups transcend ethnic boundaries thereby enhancing the potential for social cohesion.

Residents hold community meetings to discuss ways of ameliorating their living conditions by addressing the issues and challenges affecting them. Most meetings are convened by the settlement committee or NGOs interested in initiating a project. As part of the fieldwork for this study, I attended four community meetings; three of which were convened by NGOs and one by the settlement committee. Although there were a number of items on the agenda, water appeared in the agenda of all the four meetings specifically the concerns with affordability of water and the disposal of wastewater. A community member highlighted that "illegal electricity connections lead to fire outbreaks which cause extensive damage as it takes long to stop the fire due to water shortage" (participant, community meeting 3, 29-10-18).

In another community meeting the discussion revolved around the challenges of provision of water services in the community. A resident expressed his frustration saying, "unlike other settlements such as Kibera, we do not have a voice as we live in fear of cartels which makes us silent witnesses of crime" (participant, Mukuru community meeting 2, 20-08-19). Another community member stated that, "…. we have to believe that we have power to improve Mukuru (...) let us unblock the drainages and collect garbage and not wait for the

government" (Participant, community meeting 2, 20-08-19). Based on my observations of the community meetings, the organizers (the settlement committee or NGO) focused more on passing information to the residents rather than getting the community involved in decision making. This observation resonated with Linton's (2010) argument that community meetings can become a mere formality where stakeholders and participants are symbolically included without real interest in their contribution to solving water problems. A resident indicated that, "I attend the meetings as a community member though nothing changes thereafter" (Personal communication, resident 5, 28-08-18).

Although in my fieldwork I did not pose a direct question on the meaning the residents attribute to water or their understanding of water, the related discussions revealed that their behaviour and sense of responsibility with regard to water derived from their diverse understandings of water. The meanings of water are based on the experiences that the residents have with water and their beliefs about water. Sometimes the meanings attached to water as well as the practices emanating from them were contradictory. For instance, a community leader in Mukuru indicated a contradiction when he said that "water is life, but in this settlement, water is also death" (Personal communication, community leader 1, 20-08-18). He further elaborated that while residents were aware of the many facets of everyday life that depend on water, they were also cognizant of the risks that participating in the governance of water services in the settlement exposed them to because of the dominance of the cartels (ibid.).

Evidence from interviews showed that previous participation in the governance of water services by residents can lead to violence and in some instances death due to water-related conflicts (as well as the determination of the cartels to continue dominating the market at any cost) and the residents thus perceive water as death-risk as well. These findings are contrary to a similar study of access to water services in Accra, Ghana by Peloso (2014) where the willingness of some residents to participate in water governance and to get involved in matters regarding water is linked to their understanding of water as life. In order to mitigate this risk, residents act as a collective through SHGs or CBOs to conceal their identity and thus minimise the chance of being singled out by the cartels. Therefore, because the residents perceive water as life, they are willing to take part in governance activities as a collective but not as individuals. A female resident put it this way, "water is life since it affects many aspects of our everyday lives but the fear of violence from the cartels keeps us from attending the meetings" (Personal communication, resident 15, 29-11-18). Thus, the meaning that

the residents gave to water influenced their level and mode of participation in the governance of water services in the settlement.

The engagement of actors with water services is imbued and mediated by diverse meanings such as "water as the spirit, as life, as social, connective substance, as wealth and power, as generative source and regenerative sea, as nature, id, emotion and unconscious" (Strang, 2004: 245). Thus, the importance of water goes beyond immediate consumption and extends to political, legal, cultural and symbolic meanings that people give to water. Besides, the meaning attached to water by different actors influence who has access to water and through what processes (ibid.). Equally, in a study of water services in Khartoum, Sudan, Zug (2014:44) found that 'the attribution of meaning to water ultimately enters the waterscape not only as a ritual practice but as an everyday transaction that affects the inequality of water access". Further, the meanings that water bears "not only in terms of its microbiology (…) but religious ritual, its processes of production and circulation (…) and citizenship it symbolizes and (often) materializes (…) it delivers life and death, dirt and purity, toxicity and vitality" (ibid.:220-221). Hence, the residents of Mukuru attribute different meanings to water as they engage with it in different spaces and times.

5.4.4.2 Gender Dynamics

Investigating actors and their roles in water services entailed examining how the difference in gender influenced the experience of provision and governance of water services. A water vendor explained that, "it is expected that women should ensure that there is sufficient water for the household" (Personal communication, water vendor 5, 29-08-18). In their findings on two case studies of informal settlements in Kenya (Kibera in Nairobi and Nyalenda in Kisumu), Davis et al. (2012) reveal that on average, women made two round trips to the tap and spent 105 minutes daily to procure water. Whereas the responsibility for fetching water within the household fell mostly on women, I learnt that older children were engaged in procuring water as well. A female resident explained "we draw a rota so everyone including the children collects water" (Personal communication, resident 15, 29-11-18). However, in an interview, a male resident disclosed that, "since I am unemployed, but my wife works, so I am responsible for ensuring that there is enough water in the house" (Personal communication, resident 12, 25-11-18).

Additionally, during the transect walks, I observed how gender dynamics influenced the composition of queues at water points and the extent of bargaining over the price (see discussions in Section 4.5.1). On the

one hand, men opted for the express queue while women chose the conventional queue in order to save money. I invited a male resident to articulate the underlying reason for the observation and he revealed that "you know women are frugal and they prefer to save money than time and men are impatient" (Personal communication, resident 7, 1-09-18). During the FGD, a female resident explained that, "men do not bargain to protect their ego but women need to spare money for other household needs" (FGD 2, 20-10-18). During an interview a working female resident indicated that, "I work eight hours daily, so spending one to two hours fetching water is a lot of time" (Personal communication, resident 15, 29-11-18). This view demonstrates the relative notion of time whereby the working women compared the time spent on collecting water to their time available outside working hours. This finding resonates with Harris et al. (2016) comparative study findings in Accra Ghana and Cape Town, South Africa where they noted that intersectional analysis is useful to nuance and better understand gender differences in water access, use and disposal. A vendor further explained that, "when there is water, men buy water in the evening between 6 pm and 7pm after work" (Personal communication, water vendor 5, 29-08-18).

From the FGDs and interviews, I learnt that women wake up to collect water for their domestic chores at night especially during periods of water scarcity because water is usually available only at night. Equally, interview responses from residents indicated that water rationing schedules created a gendered allocation of tasks in the household. A resident stated that "women go out at night to look for water since the majority are unemployed and do not need to get up early for work" (Personal communication, resident 12, 25-11-18).This finding was contrary to Wutich (2009) study of water services in Cochabamba, Bolivia that during times of water crisis, gender differences were less pronounced because emotional distress caused by scarcity propelled both men and women to search for water.

Interviews with residents, community leaders and water vendors revealed that women ventured into the water business registered under their husbands' names or that of male relatives. A water vendor disclosed that "most women oversee their husbands' water business" (Personal communication, water vendor 7, 26-08-18). Furthermore, interviews with key informants showed that women did not constitute the cartel ring. A community leader intimated that "the operations in the cartel are dangerous for women to be engaged" (Personal communication, CBO leader, 25-08-18). However, the voice of married women was not totally unheard given that their husbands' (many of whom were not directly involved in the business) depended on them for market intelligence on matters discussed in various community fora related to water. Consequently,

in the water vendors' meetings men expressed views that were based on information received from women. Besides, although women were included and participated in community meetings where they gathered information about the water situation in the settlement, they were implicitly excluded from meetings where key decisions on water were made by the cartels.

During an interview, a female resident revealed that "reliance on the male dominated cartels for the provision of water to run the business generates stress" (Personal communication, SHG head, 14-09-18). Further, interview responses showed that women experienced greater emotional stress due to negotiations with powerful social networks such as cartels in order to access water services both for their households and the community projects. This finding resonates with a similar study of Wutich and Ragdale (2008) in Villa Israel, Bolivia, where gender emerged as a key predictor of water related stress among women. Further, the study found that women were susceptible to stress primarily due to inequalities in water access as opposed to water scarcity as such. Women found the negotiations for access to water services stressful primarily due to the uncertainty of the outcome of the process. Likewise, the rationing of water supply is a source of stress for women who not only have to look for water but also rework the schedule of activities to accommodate the availability of water as well as maintain good relations with their neighbors to stay informed about the water services situation. Water fights involving women often break out due to water scarcity generating more apprehension for women (ibid.). The discussions above point to the critical role of people-as-infrastructure and particularly of women-as-infrastructure in accessing water services in informal settlements as discussed in Section 2.2.2.

5.4.5 Residents, Practices

I now turn to the practices of residents in Mukuru as analysed in Table 5.1. The practices mainly include:

- Gaining and maintaining access to water services
- Denial of access

5.4.5.1 Gaining and maintaining access to water services

Faced with inadequate water services, residents employ a conglomeration of coping strategies and infrastructure in order to deal with the situation. Their coping strategies reveal the individual and collective agency of the residents as opposed to being passive victims of their circumstances. Coping, in this case, constitutes not only what the residents do in the absence of adequate water supply but also what they do to

maintain access to water services. The residents alluded to the evolution of the coping strategies for example to cater for the growth of the household size or change in marital status for instance, additional children in the family would imply higher water requirements due to the increased laundry activities. A resident explained how water use is also influenced by the age structure of the family "young children follow instructions, but it is difficult to restrict the older ones" (Personal communication, resident 1 interview, 23-08-18).

Besides, this same resident pointed out that finances were a crucial determinant of the coping method chosen by stating that, "I have a stable income so I can afford water but for an unemployed person water could be unaffordable" (ibid.). For example, residents pointed out that the use of water storage tanks requires a huge initial cash outlay which the majority of the residents cannot afford. Due to the unpredictability of the water availability and affordability, residents re-evaluate and re-assess how they are going to cope with and adapt to the situation both in the short and long run. A resident said that, "water goes at any time and you cannot be sure when it will come back" (Personal communication, resident 4 interview, 28-08-18). The wide range of coping strategies demonstrate the creativity and agency of residents in dealing with the fluidity and dynamism that characterises water services in informal settlements. The discussions highlight that households employ several coping practices simultaneously primarily based on social and power relations between the different actors. Social and power relations create unequal access to water services which further deepens the vulnerability of the residents.

The different coping strategies devised by the residents are appraised in detail under the following headings which were also captured in Table 5.1:

- Reusing and recycling wastewater
- Storage in kegs or jerricans
- Behavioral coping practices
- Borrowing from networks/water gifting
- Social networks
- Abandoning meters

Reusing and recycling wastewater

Wastewater can either be grey water or black water. Greywater is wastewater from household uses such as cooking, bathing and washing while black water is water from the toilet plumbing system. Given that about 50% to 80% of domestic wastewater is greywater, reusing wastewater yields significant water savings for households (Eklund and Tegelberg, 2010). The poor state of sanitation infrastructure in Mukuru makes it difficult to capture blackwater for further treatment towards reuse or recycle. The residents explained how they reuse greywater saying, "water used for washing clothes is reused to clean latrines or the house" (Personal communication, FGD, 10-10-18). The residents explained that "we keep reusing the water until it is no longer reusable" (Personal communication, resident 1, interview, 23-08-18). During an interview in a resident's house, I observed that wastewater was accumulated in a large bucket positioned close to the door. Upon enquiring the reason for accumulating the wastewater he said that it was going to be used to flush the toilet (Personal communication, resident 7, 1-09-18). In the FGD, the residents pointed out the health concerns arising from reusing greywater such as breeding of mosquitos, foul smells, waterlogging in the surrounding areas and risk of children playing with the wastewater (FGD, 20-10-18). These concerns notwithstanding the residents have no alternative than to reuse the water. It is relevant to note that wastewater contains nutrients which could improve urban agriculture thereby alleviating poverty. During the interviews residents explained that they did not reuse greywater for urban agriculture. A resident responded that, "there is no space for urban agriculture…. greywater contains chemicals which are harmful to health" (Personal communication, resident 12, 07-09-18). This resonated with the views of Gallaher et al., (2013) study in Kenya on the risk of transmitting diseases if vegetables are watered with contaminated greywater.

Storage in kegs or jerricans

During an FGD, a resident intimated that, "as the houses are small, we raise the beds with stones to fit the jerricans under the beds" (Personal communication, FGD 1, 26-08-2018). In the same FGD, residents further elaborated that the result was that the houses tend to be humid which leads to infections such as pneumonia and bronchitis (ibid.). Households buy surplus water and store it in kegs or jerricans in the house from which the household members then draw as needed. The amount of water stored depends on the storage capacity and the space available in the house. From the interviews, residents disclosed that, due to high levels of uncertainty of water supply, they ensure that water is always available in the house through storage in kegs or jerricans which also exposed them to health hazards such as respiratory infections. In a similar context, in a study of Accra, Ghana, Peloso (2014) found that access to stored water gave residents greater freedom to

undertake activities such as sleep without fear that the water will come back at a time when they were not available to fetch or buy.

Behavioural coping practices

Behavioural mechanisms involve lifestyle changes to conserve water and engaging in water-uses that are unavoidable. For instance, this might entail foregoing or reducing the frequency of washing clothes or bathing until water is available and affordable. Expounding on behavioural practices, a resident disclosed that, "some activities such as washing clothes or bathing are avoidable but drinking and cooking are not" (Personal communication, resident 2, 23-08-2018). Equally, during the FGD, residents intimated that they sent their children to their rural homes during periods of extreme water scarcity given that water borne diseases are prevalent in those periods.

Interviews with single male residents revealed how buying services instead of procuring water to carry out the activities at home helped them cope with water scarcity. A young male resident reported that, "I buy cooked food and pay to shower in the ablution block" (Personal communication, resident 12, 07-09-18). This option was only viable for residents who have a relatively good income and for households that had no children. The same male resident explained that "buying services in those times is convenient though last year I got sick after eating out" (ibid.). This finding indicates that while behavioural coping strategies are effective for water conservation, some mechanisms have adverse effects on other facets of life such as health and education.

Borrowing from networks (water gifts)

Water gifts are neighbourly water transfers through which residents procure and access water by relations of reciprocity and the trust built in their networks (Zug and Graefe, 2014). As illustrated in Figure 5.8, Zug (2014) highlights the three conditions which facilitate water gifting as spatial heterogeneity, cost of the gift (cost of the water, transport and transaction costs) and the social transaction (water morals and social embeddedness). Further water gifts occur in a context of spatial heterogeneity where the social distance between the 'water-rich' and the 'water-poor' is large (ibid.). Thus, water gifting becomes an everyday practice that is characterized by inequality in water access.

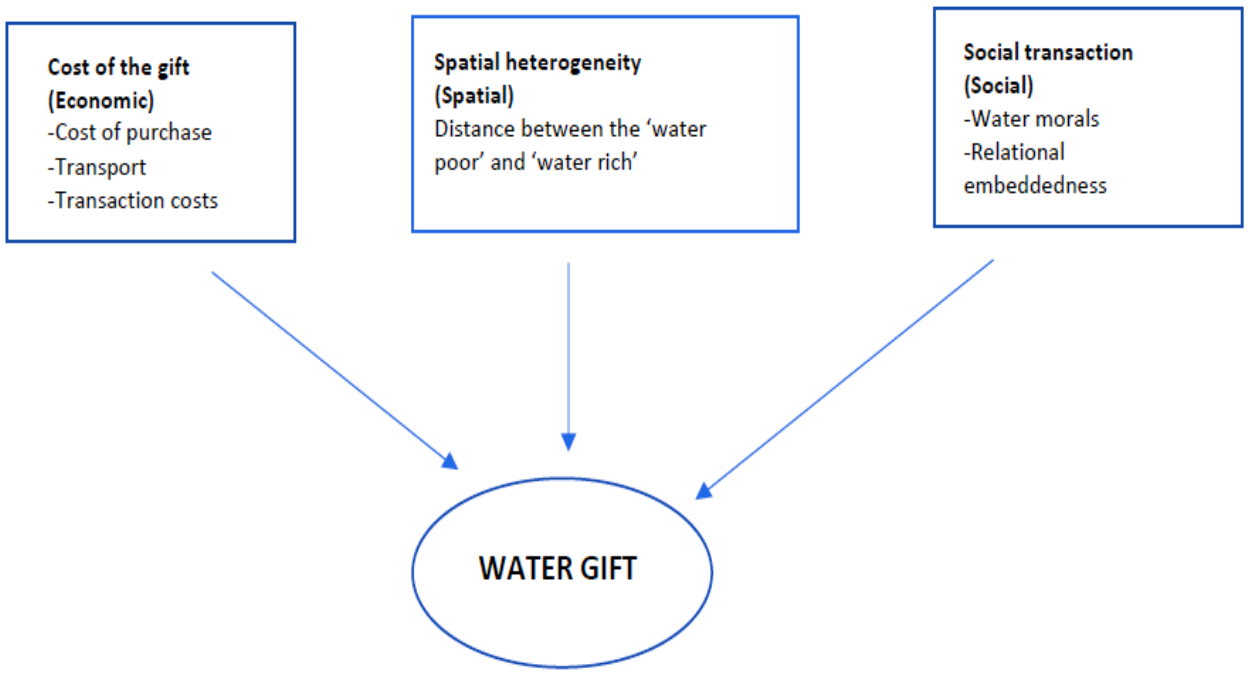

Figure 5.8: Elements of the water gift (Source: Adapted from Zug, 2014:37)

A resident revealed that "when I do not have water, a relative who lives nearby gives me" (Personal communication, resident 1 interview, 23-08-18) and another said that "I borrow money to buy water or borrow water from my relatives or friends and I return later because they also come to my house to borrow or other things" (Personal communication, resident 6 interview, 07-09-18). This finding suggests that water gifts entailed reciprocity whereby the receiver 'returned' the water in a similar or different way in future. Borrowing water from networks is a form of "water gift" which is a non-paid source of water for households that cannot afford to buy or have no water access. However, the residents indicated that water gifting was a short term coping mechanism. A resident disclosed that, "one cannot keep borrowing water from others as it strains the relations with relatives or neighbours in the long-term, people get tired of giving you know" (Personal communication, resident 12, 25-11-18).

Contrary to Zug (2014) assertion that gifting is unlikely to take place if there is little spatial heterogeneity, water gifting is a prevalent practice among residents of Mukuru where residents mainly engage with people spatially close to them and the dealings intensify the closer the houses are to each other and diffuses the further they are from each other. This is because the greater the proximity of households the higher the likelihood that their activities intersect and coincide. The cost of the water is the price paid by the donor to procure water while the transaction costs include the cost of physically moving the water from the donor to

the recipient's premises. Thus, a donor with a metered connection is less likely to engage in water gifting since the bill payable increases. However, given the low socio-economic status of residents in Mukuru water gifting is based on the altruistic and solidarity values embedded in culture which encourage the exchange of water among neighbours (ibid.).

Besides, interview responses from a resident revealed that households without prior social relations engaged in water gifting out of sympathy. He stated that, "when I am desperate, I send my 5-year-old son to my neighbours to borrow water since they cannot deny him" (Personal communication, resident 2, 23-08-2018). This finding is contrary to Brewis et al., (2019) which was based on a comparative study of water sharing in eight sub-Saharan countries found that water gifts in urban areas were based on social relations underpinned by factors such as religion, social values, kinship or business ties.

Social networks

In line with Bourdieu's (1984) field theory reviewed in Section 2.6, the extent to which residents access information from their social networks concerning the water situation in Mukuru shapes their ability to access water services. In addition, from my conversations with residents, I realized that gaining and maintaining access to water depended on their information networks and connections. Residents reported that when the water came back at night, they called their relatives and friends to inform them where to find water, the price and the length of the queue. In an interview, a resident complained that no one gave him information about the availability of water stating, "my neighbours do not wake me up when water comes back as I hardly interact with them" (Personal communication, resident 8, 24-08-18).). Interview responses revealed that residents accessed information in the form of rumours, speculation and hearsay and that access to various sources of water is influenced by their linkage(s) to social networks. Consequently, the fluidity of the water situation in the settlement implied that the relevance of the information was short lived. As one resident elaborated, word of mouth was the prevalent mode of communication in the networks stating that, "…my brother and I inform each other about the water rationing schedule or where to find water" (Personal communication, resident 1 interview, 23-08-18). Another resident reported that "we usually knock on people's doors to announce that water has come back" (Personal communication, FGD 2, 20-10-2018). The Mukuru community also organizes protests as a strategy of getting the attention of the state. Box 5.2 contains media reports of protests by Mukuru kwa Njenga residents due to lack of adequate water services and the impact of the situation on their everyday realities.

BOX 5.2: Media reports on water in Mukuru

Mukuru kwa Njenga residents challenge Sonko to intervene as cartels cut off County water pipes

Irate residents at Maziwa area in Mukuru kwa Njenga located in Embakasi South, Nairobi county protested of acute water shortage in what they said was a cartel by some individuals to sell water to them. Taps have run dry without water since April this year. A resident, James Malonza said they have been disconnected to water in their meters yet water is channelled to vendors who sell 20 litre jerrican at Sh20. Boda boda operators are also affected after the spill of water from burst pipes have rendered an access road impassable. A business lady, Lydia Chepkemboi claimed business is affected since customers cannot access shops due to the muddy and dilapidated road attributed to a water spill.

Source: Daily Nation Newspaper Online

Queueing for water in Mukuru further demonstrates the role of social networks in accessing water services. There are 2 types of queues for water; the express queue which has no waiting time and the regular queue. Although the queues operate on a first-come-first-served basis, rowdy residents and those who can push and shove usually jump the queue. In a similar study of service provision in Buenos Aires, Argentina, Auyero (2012) found that waiting time was commensurate with power so that the more powerful citizens wait for services for less time. The less powerful residents endure queueing for water services because they have no alternative. Quarrels and fights erupt on the queue especially when some residents attempt to jump the queue which demonstrates the influence of power dynamics of waiting (ibid.). In an interview, a female resident disclosed what she did as she waited on the queue stating that, "we gossip about the happenings in the village and also make friends since these people help you later on when there is no water…" (Personal communication, interview resident 12, 07-09-18). This finding indicates that the interactions on the queue among residents served as an opportunity for forging useful social networks for ensuring continued access to services in the future. Besides, waiting at the queue creates space for the residents to mutually experience their powerlessness in having to wait their turn to access water services without knowing the outcome of the wait. Appendix 3c-8 presents additional data on the queues for water procurement.

Abandoning meters

In order to continue accessing water, residents abandon their meter accounts and apply for a new meter connection through another family member. During an interview, a state official explained that "in a family the

father applies for a meter connection and when the water bill accumulates, he abandons the account and the mother applies for another connection and when the cumulative amount is high, their son or daughter opens a third account so you never recover debts"(Personal communication, state official 2, 05-10-18). Another NWSC official intimated that "few people in Mukuru have meter accounts under their names because people sell the connections" (Personal communication, state official 7, 08-10-18). The findings suggest that residents are hesitant to get metered connections due to the anxiety of paying monthly bills (which were deemed to be unintelligible by most residents) and the perception by residents that such metered connections made them dependent on the formal water services provision which was unreliable. Likewise, a connection curtails innovation and creativity of both the residents and water vendors in securing water from multiple sources. Another state official indicated that residents abandon metered connections because, "bills are non-negotiable and must be paid because technology-based billing system showed the outstanding amounts" (Personal communication, state official 5, 26-08-18).

5.4.5.2 Denial of access

Although the presence of infrastructure such as the water kiosks offer expectations of service delivery, most of the water kiosks are non-functional and do not yield water. The non-functional hydraulic infrastructure in the settlement have been converted into other uses (such as kindergartens or private accommodation) by the residents (see Figures 5.9 and 5.10 and Appendix 6). Interview responses from the residents indicate that they vented their frustration of lack of water services on the state by adapting the abandoned infrastructure for other purposes. A resident disclosed that, "it is annoying to have these kiosks and they do not produce water" (FGD 2, 20-10-18). Figure 5.9 shows a water kiosk previously run by a CBO which is subsequently rented to one of the CBO members as a chicken pen. Likewise, Figure 5.10 depicts a water kiosk that was converted into a kindergarten run by another CBO. The repurposing of the abandoned infrastructure is contested since various parties are interested in appropriating the facilities. A CBO leader explained how these contestations were resolved stating that "…we agreed that rental income should be distributed equally to the members" (Personal communication, CBO leader, 30-08-18).



Figure 5.9: An ablution block in Milimani village adapted into a chicken pen



Figure 5.8: A water kiosk in Moto Moto village adapted into a kindergarten school

5.5 INITIAL REFLECTIONS ON ACTORS IN WATER SERVICES IN MUKURU

The data and analyses presented in this chapter shows the dynamics around water in order to primarily demonstrate the elements of people-as-infrastructure as the key concept of this study (see related discussion in Chapters 1 and 2 as well as summary on Table 5.2). An intersectional analysis of the gender dynamics produced a nuanced understanding of the different gender roles in gaining and maintaining access to water services. The responsibility of securing water for the households primarily falls on women and their bodies form a significant component of the infrastructure for the last mile delivery of water services. Thus, the notion of people-as-infrastructure in to access to water services is in reality women-as-infrastructure. Given that women have a limited role in related decision-making processes (on water services and repairs of the hydraulic infrastructure), this illustrates their symbolic inclusion and material exclusion in the governance of water services. Besides, the knowledge on physical/material water infrastructure was largely the purview of men and thus the concept of people-as-infrastructure with regard to repair of infrastructure can be nuanced as men-as-infrastructure.

Table 5.2: Elements of people-as-infrastructure in relation to governance

People-as-infrastructure dynamics	**Evidenced by**	**Relation to governance**
Social networks	-Access to water services is influenced by negotiations and engagement between actors. -Social relations created and fractured on the queues. -Water gifts occur through social relations. -Social relations among CBO and SHG members in water services provision. -Power imbalances in coproduction of water services.	-Governance as fragile and the outcome of negotiations and engagements between state and non-state actors. Participatory governance of water services. Porous boundaries between formal and informal governance
Repairs	-Negotiations between state officials and residents to access knowledge of the infrastructure.	-Governance as the outcome of distributive agency of diverse actors. -Water governance as diffusive.
Gender	-Female body used for last mile delivery of water. -Knowledge about the reticulation of water.	-Women-as-infrastructure and men-as-infrastructure. The plurality of modes of water governance.

Normally, infrastructure has been the means through which the relationship between the citizens and the state is mediated such that the state provides infrastructure and the residents remain as recipients of the related service. The infrastructure is also perceived to be technical and requiring specialist knowledge and expertise which the state holds while citizens pay taxes to cover the cost of service provision. In Mukuru, the situation is inverted because the state comes in to provide infrastructure and then the cartels and the residents engage in a contestation to reengineer the entire waterscape to suit their respective interests. They incrementally and gradually change it, switch it around and move pipes and pumps along to put them where they need them. The infrastructure is moved around in such way that it is difficult to predict where the water is going to flow from. Consequently, it is the residents and the cartels who have re-imagined and re-engineered the environment and have the mental maps of how and where the infrastructure has been moved. The water vendors and residents are the holders of the infrastructural knowledge thus becoming the experts of the local water reticulation system.

The Mukuru case demonstrates knowledge as a significant component of the infrastructure whereby local plumbers carry out repairs without reticulation maps from the NWSC officials since they know where the pipes are located, and as a result the state has weak infrastructural control. This has been further refined under findings and conclusions in Chapter 9, and especially on Figure 9.2. In addition, state officials not only need infrastructural knowledge but also negotiation skills so as to access information from the residents. The expertise of the state officials is generated through intimate and close relations with people and material elements of the water infrastructure. An infrastructure lens thus diffuses state authority and renders it porous by generating more points of interaction with the various actors. The findings of this chapter seem to contest the attribution of agency to solely to human actors (and assumption of passiveness of non-human elements) as one of the key aspects of normative mode of water governance, and demonstrates that agency is more broadly distributed even to material as well as non-material infrastructure, including knowledge. Thus, the outcome of the diverse actors' distributive agency configured through discourses, practices and experiences especially in dealing with the inadequate water services clearly demonstrates a non-normative mode of governance of water services.

Consequently, the state equally depends on this other kind of expertise and technical knowledge which thus renders the situation contrary to conventional expectation or understanding based on a normative mode of governance. This finding resonates with Bjorkman (2014) study of water services in Mumbai, India where water access by residents required keen attention, politics of stealth and thorough knowledge of complex and fluid social and political processes. Bjorkman further states that water flow is influenced by rumour, politics and spectacle making the hydraulic infrastructure a system of social and material

elements that are simultaneously “becoming-and-falling” apart as well as co-constituted and re-constituted on an ongoing basis.
4

The presence of chambers at the periphery of the settlement could be viewed as a mode of invited coproduction by the NWSC to the residents to participate in the provision of water services. Ostrom (1985) contends that coproduction of knowledge takes place because institutional tools such as rules and communities are knowledge-based such that actors need to be clear on their roles and expectations to improve process efficiency. Moreover, knowledge is required to understand the nature of the service itself and how it should be produced. Equally, the actors themselves produce knowledge through their involvement in the process. Through negotiation and contestation, knowledge is co-created by the synthesis of different approaches and experiences of multiple actors to produce a new set of assumptions and beliefs (Miller and Wynborn, 2017). In line with discussions by McFarlane (2009) and Bourdieu (1986) as reviewed in Section 2.7, coproduction is laden with power imbalances which shape the power relations between actors and affect ‘who gets what, when and how’ as part of the process of governance of water services.

Finally, the chapter has foregrounded the role of silence and inaction in creating a dominant narrative and discourse about the inadequacy of water services in the informal settlement. Different actors employ silence to serve different purposes such as the silence of lower level managers about outstanding accounts belonging to senior NWSC officials. Equally, the cartels are quiet about the violence that infrastructure generates among water vendors while the residents are silent about the wells in their houses to avoid disturbance by their neighbours. The silence by different actors about certain aspects creates inequalities of water access by actors within the city which in turn r(e)produces the narrative of water scarcity. Further, silence and invisibility by actors in their everyday life adds complexity to water governance since decisions have to be made on who decides what should be seen and what should be ignored as well as what should be absent and what should be present.

CHAPTER SIX

6 CONDITIONS AND CHALLENGES OF WATER SERVICES IN KYA SANDS

6.1 INTRODUCTION

The chapter explores the role of both material and non-material infrastructure in mediating access to water services. Specifically, it shows how the state is made visible through hydraulic infrastructure. Equally, the chapter will examine the visibility by the state of the provision of water services given that attention is given to what the state sees. In other words, what does the state choose to see or not to see? Why? For instance, in Kya Sands the wastewater disposal problem and illegal connections seem invisible to the state. In line with Razon (2017), I argue that aspects not seen by different actors have power dynamics which may render them invisible to actors at different times and in different spaces and what remains unseen is not prioritized. Furthermore, the chapter will show how the Apartheid system which was intentionally and structurally designed to deny some people access to water services continues to impact on service provision to date. Besides, the chapter reveals that social relations are crucial in gaining and maintaining access to water services in a manner similar to Bourdieu's field theory as reviewed in Section 2.6. Moreover, the chapter will argue that hydraulic infrastructure is shaped and shapes as well as underpins social, spatial (from apartheid planning) and power relations. The strong visibility of the state in provision of water services in South Africa is perhaps motivated by the need to redress the legacy of apartheid cleavages of service provision along racial lines and unprecedented rates of urbanization.

This chapter therefore addresses the first sub-question on the conditions and key challenges of water access, use and disposal in informal settlements as the context for investigating the governance of water services in Kya Sands. Data on the sub-question for both case studies have been analysed in a similar manner (see description of data analyses on Sections 3.7 and 4.1). The first section of the chapter presents a background section with the development and evolution of the settlement as well as the physical, socioeconomic and legal profiles. Examining the trajectory of these profiles provided the context of governance of water services as well as a deeper understanding of why or how the observed practices emerge and evolve. The chapter then presents the conditions of water access, use and disposal. The challenges faced by various actors in water services are highlighted throughout the chapter. Table 6.1 shows the approach to data coding and analyses.

Table 6.1: The conditions and key challenges of water access, use and disposal in Kya Sands

Key data themes guided by sub-question 1	**Sub-Themes**	**Secondary data** **Key data types and sources**	**Primary Data: Transect walk and direct observations** **Key data types and items**	**Primary Data: Interviews & FDGs Responses** **Key data types and items**
THEME: Conditions of water access, use and disposal	-Location, geographical extent & morphology	-Aerial maps and satellite images (no or minimal adaptation) -CoJ report (2007) -Google earth maps -Olumuyiwa (2016) study of just sustainability in Kya Sands. -Rakodi (2014) -Weakly (2013) study of resilience in Kya Sands	-Grid street layout of some sections of the settlement. -The different sections of the settlement. -The Jukskei river -The industrial area -Landfill site	-The start year of the settlement -Formal recognition of the settlement -The demarcation of Kya Sands into sections. -Flooding of the houses during the rainy season and runoffs from standpipes. -The growth of the population and changes in population density.
	-History & growth	-History, evolution and development of the settlement. -Olumuyiwa (2016) study of just sustainability in Kya Sands. -Weakly (2013) study of resilience in Kya Sands -Wits City Institute (2013)	-The changes in the quality of buildings across the settlement. -The variations in the building materials used. -The different sections of the settlements -The Jukskei river. -The Kya Sands industrial area -The landfill site	- The relationship between Kya Sands growth and nearby informal settlements -Land occupancy over time. -Executive settlement committee -The demarcation of the settlement into sections -Plans for in-situ upgrading of the settlement. -Fluidity and inorganic growth

		-Google earth maps		
	-Demographics & livelihoods	-Olumuyiwa (2016) study of just sustainability in Kya Sands -Weakly (2013) composition of the settlement committee -CoJ report (2007) -Professional Mobile Mapping report (2009)	-The economic activities in the settlement. -Variations in room layout and design. -The mix of South Africans with foreigners in the different sections -Ethnic composition of settlement	-The ethnic/migrant status composition of the settlement. -The role of ethnic and migrant status identity in access to services. -Fluctuating demographics -Ward councillor
	-Physical/Material infrastructure (including houses)	-Olumuyiwa (2016) study of just sustainability in Kya Sands. -Weakly (2013) overview of the settlement	-The hydraulic infrastructure including the stand-pipes, jerricans at the water points etc	-Installation of stand-pipes
	-Mechanisms of management-of-access Legal and institutional frameworks	-1996 Constitution -Toxopeus (2019) -Dugard (2016)	-No observation	-Universal access to water enshrined in the constitution of South Africa. -Right based approach to water access. Mazibuko vs CoJ case.
		-1998 Water Act -von Koppen et al., (2009)	-No observation	-Development of policies with Apartheid regime. --Pro-poor approach to water services provision. FBW policy
		-South African Water Policy -Eales (2009) -Schreiner and Hassan (2011)	-The queues at the water points	-Water supply within 200 metres -FBW policy

	Institutional frameworks	-Department of Water and Sanitation (DWS) -Eberhard (2012)	No observation	-Overall leadership in the water sector -Separation of water resource management and services provision -Regulator of water sector
		-Rand Water Board (RWB) -Eberhard (2012) -Maphela (2015) -Rand Water (2017)	No observation	-Bulk water management -Regulated by CoJ
		City of Johannesburg (CoJ) and Johannesburg Water (JW). -Eales (2010) -Dugard (2016)	-JW manages the water in the settlement. -Responsibilities of JW/CoJ -Challenges faced by JW/CoJ	-Financing of WSPs -FBW policy
THEME: Challenges of water access, use and disposal	Tenure uncertainties	Lagardien and Muanda (2014) -Olumuyiwa (2016) study of just sustainability in Kya Sands. --Weakly (2013) Process of acquiring land from the settlement committee	-Variegated quality of the houses across the settlement.	-Majority of the land is public. -Private land is leasehold land. - Provision of services -encroachment -Myriad of stakeholders. -The process of land acquisition -Lack of formal documentation for land ownership. -Influence of apartheid regime on access to services. -Vandalism of infrastructure.
	Affordability	Weakly (2013) overview of the settlement. CoJ (2007) report Williams (2010)	-Residents collecting water at the standpipe for 'free'.	- FBW ;No billing for the water -Time and energy spent to procure water. -Sense of entitlement.

	Quality concerns	-Weakly (2013) overview of the settlement. -Olumuyiwa (2016) study of just sustainability in Kya Sands -Lagardien and Muanda (2014)	-My guide drinking water directly from the standpipe. -Foul smelling stagnant pools -Jerry rigged wastewater tunnel emptying into Jukskei River -Crates to hold back wastewater and floods -Notes from the field diary -Appearance of the water -Unhygienic practices such a doing laundry at the tap that affect water quality Figure 6.12	-Quality of the environment around the stand pipe. -Behaviour of residents around the standpipe. -Foul smell around the standpipe.
	Supply uncertainties	-Olumuyiwa (2016) study of just sustainability in Kya Sands. -Infrastructural violence Ahlers et al. (2014) a literature review	-Functional standpipes Stand pipe in the settlement Functional, leaking and non-leaking taps. -Leaking standpipes -Non-functional water points -Few tanks and jerricans used to store water.	-Variations in water supply in different sections. -Overall reliable supply of water. -Temporary water disconnection to implement repairs. Communication of water disconnection to residents
	Policy/Rules uncertainties	Lagardien and Muanda (2014) Weakly (2013) overview of the settlement. Eales (2009)	-State officials did not confiscate pumps belonging to some vendors.	- Unwritten rules and residents are unaware of the rules. - The settlement committee enforces the rules. -Inadequate wastewater disposal systems and a sense of helplessness with water disposal. Mode of disposal depends on the time of the day. -Lack of willingness to collaborate in community-based water disposal. -Water disposal related inter/intra household conflicts.

6.2 LOCATION, DEVELOPMENT AND EVOLUTION OF KYA SANDS

Chapter 3 presented a brief introduction of Kya Sands as well as the reasons for selecting the study site. In this section, context specific details of Kya Sands are presented which provide a background of the situation of water services in the settlement. The settlement began in 1989 and is possibly the largest informal settlement to the north-west of Johannesburg (see Section 3.2.1). Given its strategic location next to an industrial park, the settlement constantly attracts new residents and has grown gradually (see Figure 6.1). In 2007 the municipal and provincial authorities proposed long-term interventions in Kya Sands to improve basic services provision yet to date only short-term interventions have been implemented with the resultant backlogs causing frequent service delivery protests by residents.

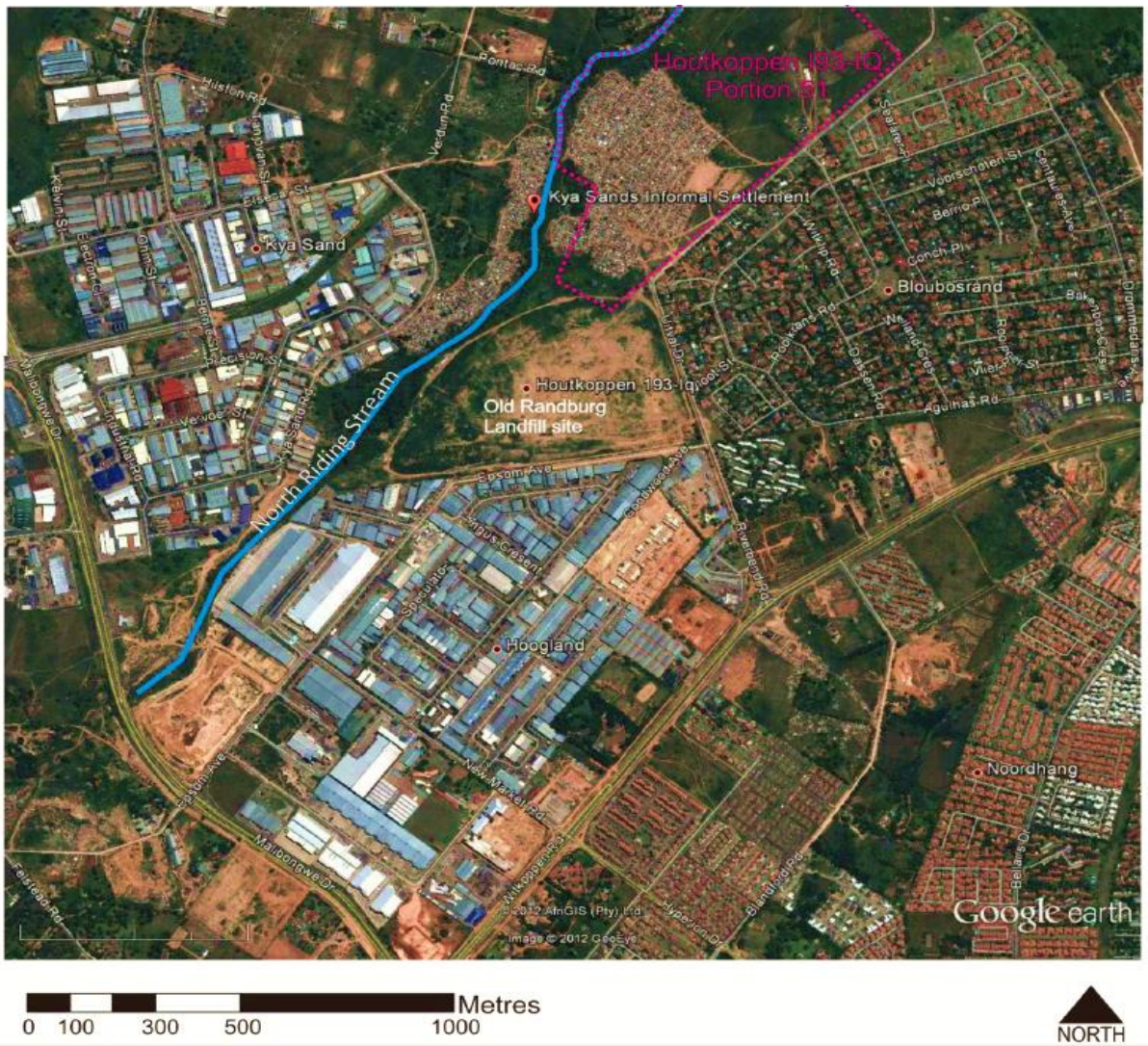

Figure 6.1: Satellite image of Kya Sands precincts and Houtkoppen 193-IQ Portion 5 (Source: Weakley, 2013:104)

The settlement is divided by a wetland and the North Riding stream, a tributary of the Klein Jukskei River which flows through the settlement to the north of Johannesburg and parts of the settlement slope towards the stream (CoJ, 2007; Olumuyiwa, 2016). The land close to the stream as well as the area where the Randburg Landfill site (Portion 46 of Houtkoppen 193-IQ) is located are owned by the CoJ. There is a dumping site with construction rubble near the stream which serves as a source of building materials for the residents. A large segment of the settlement lies in portion 51 (see Figure 6.1) which is owned by the National Government of South Africa but is run by the Gauteng Provincial Government (Weakley, 2013).

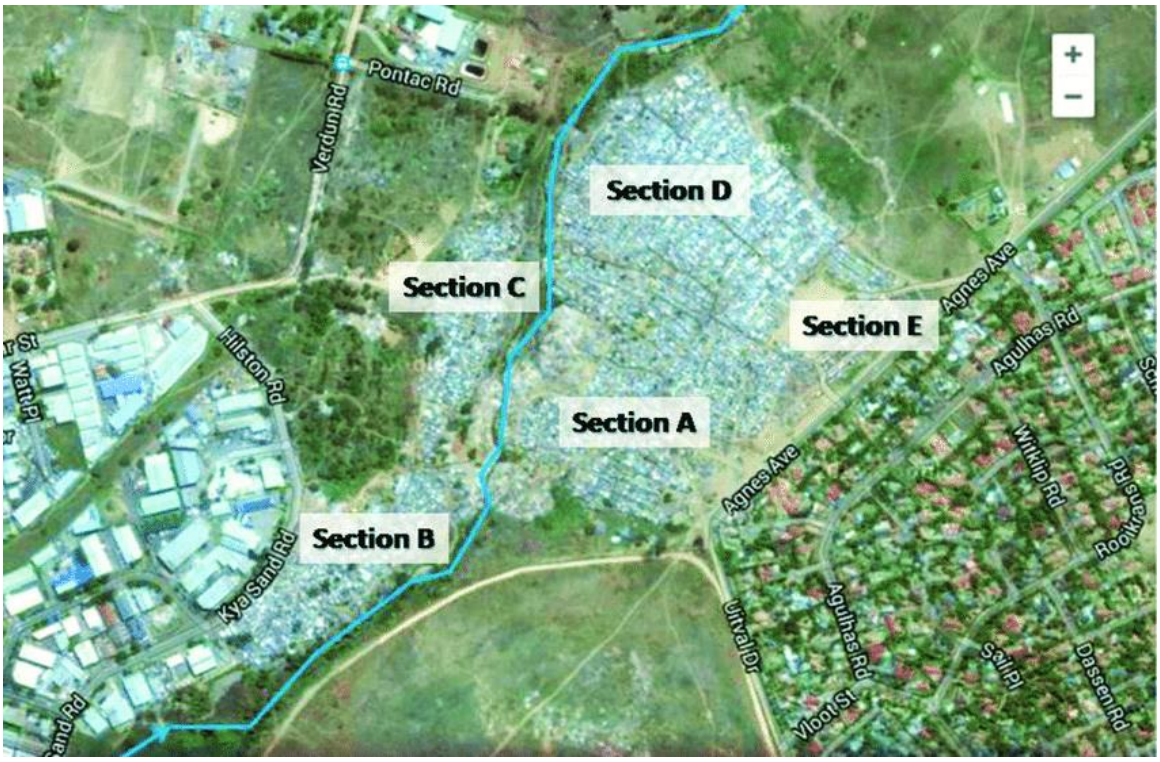

Figure 6.2: Satellite image of the five sections of the settlement. (Source: Olumuyiwa, 2016:85).

Although people working in the Randburg Landfill site are identified to have been the first to put up shacks for shelter in the early 1990s, the exact starting date of Kya Sands is contested. An interview with a female resident who is generally regarded as one of the pioneer residents of Kya Sands revealed that the settlement began in 1993. However according to a CoJ official, "Kya Sands began in 1996 and is a recognized informal settlement in Johannesburg which means that the municipality should provide basic services to them" (Personal communication, CoJ official 1, 24-01-19). In the late 1990s, the residents had been "relocated by CoJ to Zevenfontein but shortly after they moved back to Kya Sands due to proximity to workplaces and job opportunities" (Personal communication, CoJ official 1, 24-01-19).

In 2012, the Gauteng Provincial government started the enumeration, house and toilet numbering exercise in the province in which Kya Sands was divided into five sections A to E which have been subsequently used both by the residents and for official purposes as shown in Figure 6.2 (Weakley, 2013). Within the CoJ, Kya Sands was originally administered under Region A but later the settlement was demarcated (perhaps for political reasons) and now falls under two regions A and E which complicates the coordination of service provision (Personal communication, CoJ official 1, 24-01-19). Given the fluidity and dynamism of informal settlements, it is difficult to accurately state the population of the settlement and different enumeration exercises produce varying estimates. The most recent demographic survey by Professional Mobile Mapping (PMM) in 2009 estimated the population as 16,238 people with 5,325 households living on an estimated area of 38.54 acres (15.6 ha) at a population density of approximately 421/acre.

From the survey, the average number of people per household is three (Weakley, 2013; Olumuyiwa, 2016). However, most households reported that they did not live with their children as they were left with their grandparents or other relatives in the rural areas. The average ratio of children to adults was 1:3 (Weakley, 2013). A resident disclosed that “my children live in Limpopo because the living conditions here are poor and also to save money” (Personal communication, Kya Sands resident 5, 14-11-18). During the interviews, some residents revealed that they were subletting the house to other tenants hence some houses had two or more households.

After the visit by Mayor of Johannesburg to the settlement in 2006 in response to service delivery protests, an upgrading proposal for Kya Sands was drafted in January 2007 including *in-situ* upgrading for urban strategic transformation and relocation to Lion Park for those eligible for the state housing subsidy (Wits City Institute, 2013; Olumuyiwa, 2016; Personal communication, CoJ official 1, 24-01-19). Subsequently in October 2007 the proposal was revised to encompass development plans for informal settlements in the North of Johannesburg (Weakley, 2013). However, by the time of my fieldwork in December 2018 this plan had not yet been implemented and nothing seemed to be in progress. A leading hurdle to the implementation of the long-term plans is the lack of clarity about which entity should take responsibility for executing the plans since the responsibility oscillates between the CoJ and the Gauteng Provincial Government (ibid.).

Kya Sands settlement falls under Ward 115 in the City of Johannesburg and is represented by a ward councilor (Personal communication, CoJ official 1, 24-01-19). In addition, there is a settlement committee which comprises of 25 members representing the five sections of the settlement and all of whom reside

within the settlement (Weakley, 2013) (see Figure 6.2). At the top of the committee hierarchy is the executive committee which comprises five members; the chairman, vice chairman, secretary general, treasurer and a woman representative (ibid.). The executive committee has power to take binding decisions on all matters affecting the settlement (ibid.). A committee member explained that the legitimacy of the committee is derived from the fact that the members are elected by the residents. Other members of the committee are representatives from the dominant political parties in South Africa namely African National Congress (ANC), Democratic Alliance (DA) and Economic Freedom Fighters (EFF).

As shown in Figure 6.3 the settlement has experienced steady growth in area and population, although there was a sharp increase between 2007 and 2019 due to several instances of relocation of people from Houtkoppen 193-IQ as a result of fire and flood disasters. In the recent past, there have also been state-led relocations from other informal settlements such as Msawawa and Inanda small holdings which have contributed to the growth of the settlement. Although South Africans make up 70% of the total population, there is a large contingent of foreigners mainly from Zimbabwe, Mozambique and Malawi (Weakley, 2013). The majority of the South African population (55%) originate from Limpopo Province while only 2% originated from Gauteng (ibid.).

From the fieldwork, I noted that the different sections had a mix of South Africans from the different provinces as well as foreigners. Interview responses from residents (mainly from minority South African ethnic groups such as the Venda) revealed that they felt intimidated by the major ethnic groups and relied on intermediaries (from the major ethnic groups) to voice their opinions. These residents reported that they preferred to remain invisible both to various state officials and the settlement committee. A resident complained that “we do not mix with the major groups and I am afraid to voice my concerns in meetings or to the committee” (Personal communication, resident 18, 22-11-18). Additionally, these minority ethnic groups reported that they were not represented in the settlement committee.

Out of the thirty residents I interviewed, twenty-three were on social grant from the South African Social Security Agency (SASSA). These findings are congruent with other studies of Kya Sands such as Professional Mobile Mapping (2009) and Weakley (2013) that 75% of residents interviewed were on social grants. The most prevalent grant is the child welfare grant though a few residents received the disability and medical grants. A resident revealed that “when I get the child grant, I send it to my parents because they are living with them” (Personal communication, Kya sands resident 5, 14-11-18).

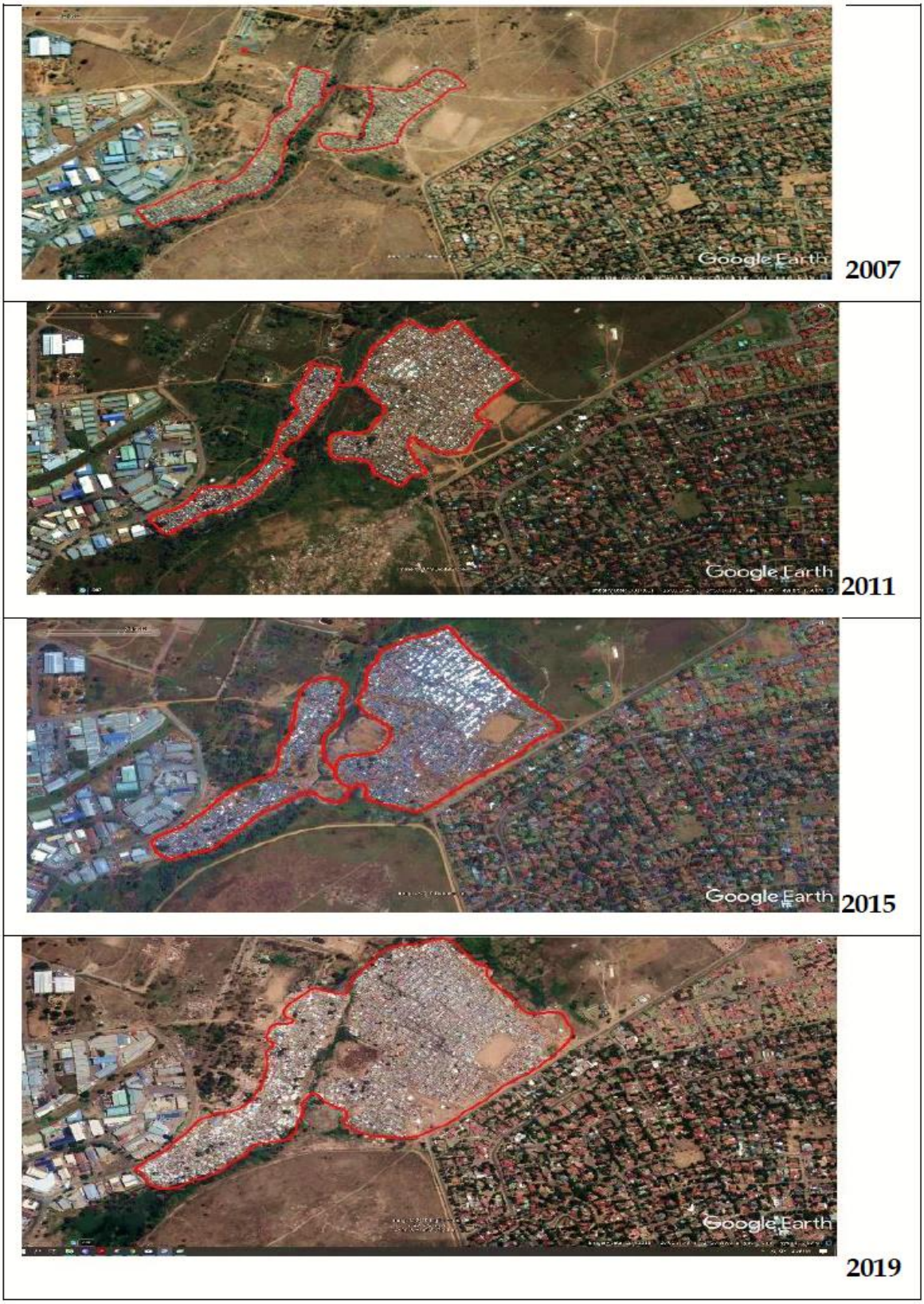

Figure 6.3: The growth of Kya Sands between 2007-2019. (Source: Google Earth, 2019)

6.3 LEGAL AND INSTITUTIONAL FRAMEWORKS OF WATER SERVICES IN SOUTH AFRICA

6.3.1 A brief Overview of the Historical Context of South Africa

Based on the analyses presented in Table 6.1, this section provides an overview of the evolution and development of the legal and institutional frameworks that govern the provision of water services in South Africa. A better and nuanced understanding of the conditions and challenges of access to water services could be reached by examining the influence of the legal and institutional frameworks of water governance. Equally, a historical context deepens the understanding of the current struggles of the residents with regard to water services. The frameworks and precedents constitute a crucial part of water governance and thus form a good point of departure for investigating water governance in South Africa. Pahl-Wostl (2015) argues that legal and institutional norms are sometimes presented or framed as a panacea for the water situation without considering the complex realities on the ground. Hence, given that institutions are partial and multiple, they should create room for manoeuvre and flexibility of both state and non-state actors. This extends governance failure in water services beyond the state and water providers to poor households who cannot connect to the network due to economic, social and political factors among others (ibid).

The development of water policies in South Africa can be better understood in tandem with the wider political-economy context particularly the apartheid regime (Personal communication, water expert 2, 31-01-19). From 1948 to 1994 the country was governed under the apartheid system, a legislatively administered racism whereby the country was segregated along racial, gender and class lines coupled with the privileging of a minority white population over the others. The apartheid regime caused inequalities in access to water services and also deprived the majority of the population access to clean water for household use and large-scale water use for productive purposes. Consequently, most of the reforms in the legal framework were motivated by the need to redress these inequalities (Eales, 2009). The rest of this section broadly traces the evolution of legislation before, during and after the apartheid era.

Von Koppen et al., (2009) state that through the enactment of the Land Act in 1913 “non-white” South Africans were dispossessed of land, water and mineral resources. This led to the relegation of non-white South Africans to native reserves or homelands where men engaged in livestock rearing and women took on small scale subsistence farming. Further, they argue that the dispossession of land and other strategic resources resulted in high unemployment among the non-white communities thus providing cheap labour

for the white-owned mines, farms, homes and factories (ibid.). Moreover, the removal of water rights due to their linkage with spatial segregation meant that only areas occupied by white South Africans had access to water services leaving the rest without adequate provision (ibid).

In a related study, Von Koppen et al., (2009b) explain that the 1970 Commission of inquiry recommended that water resources should be viewed as economic goods and subject to the forces of demand and supply. Further, the commission introduced a comprehensive water management approach towards the efficient allocation of water and water demand management. Up until that point, the reforms focused on water resources and there was minimal discussion of water services which were deemed to be the responsibility of local and regional governments that were already racially segregated. Consequently, predominantly white areas enjoyed well-reticulated water systems with uninterrupted supply while the black areas such as townships were characterized by standpipes and bucket toilets that were poorly maintained. Besides, the legislation prohibited non-white South Africans from engaging in agricultural activities or industrial undertakings which meant that they could not use water for large-scale purposes (ibid.; Toxopeus, 2019).

The 1980s were characterized by widespread riots and protests in the non-white townships clamoring for better services (Eales, 2009). Consequently, through the Department of Water Affairs, the state promoted the idea of water as a social good by basing allocation decisions on affordability especially for the non-white communities that could not afford to pay for water. Equally, decisions on water allocation to non-white communities had to compete for allocation of water to agriculturalists and industrialists and the 'environment' (which initially comprised Kruger National Park and St. Lucia wetlands) and later on was expanded to include 300 privately owned nature reserves that consumed 13% of the total water demand (Schreiner and Hassan, 2011). The inequality of access to water services meant that:

> "Black South Africans did not benefit from similar public investments, neither in water services for domestic uses nor in water development for productive uses. Without any incentive to boost the autonomous productivity of a black labour force, and with minimum incentive to share benefits with them, the hydraulic mission for white agriculture deepened inequities in access to and control over water resources" (ibid.:5).

The 1996 constitution abolished homeland governments to create national, provincial and local governance structures as well as providing guidelines for the interactions between the three spheres of governance. This led to the expansion of municipal and provincial boundaries of former white areas to

include neighbouring poor black areas which were previously underserved. At the same time municipalities faced unique challenges due to inadequate infrastructure for the provision of water services in poor black areas (Eales, 2009). The inequalities persist notwithstanding the post-apartheid implementation of changes such as water-use authorization, the adoption of pro-poor strategies, rethinking institutional arrangements and market pricing of water (Von Koppen et al., 2009a; ibid.). This could indicate that water governance does not solely reside with the confines of the state legislations and could entail the willingness of various actors to make additional responsive changes in practice and behaviour.

Apartheid structures continue to resurface especially in large scale water use for industries and agriculture as well as more constant and reliable supply of water services to formerly white areas (Mnisi, 2019). Legislation and policies such as the 1998 Water Act and South African Water Policy formulated after the apartheid regime were aimed at efficiency in water management and allocation as well as managing the environmental implications. Nevertheless, to date large scale use of water for industrial and agricultural purposes continue to be dominated by the white minority which perpetuates and further widens inequalities in access to water services in formerly non-white areas such as informal settlements and rural areas due to water infrastructure backlog which stands at 13% (ibid.).

6.3.2 Selected Legal and Institutional Frameworks in South Africa

South Africa has adopted a right-based approach to alleviating large-scale water poverty which is regarded as one of the most progressive and innovative in the world (Dugard, 2008). In facilitation of this approach, several pieces of legislation and policy instruments have evolved designed to guide the governance of water services in the country. I now move on to discuss the main legal and institutional frameworks that regulate water resources management and water services delivery in South Africa namely: the 1996 Constitution, the 1998 Water Act and South African Water Policy.

The 1996 Constitution

The constitution of South Africa duly provides for access to water services as a universal basic right and obliges the state to employ various mechanisms to ensure that this right is realized (RSA, 1996). Further, it decentralizes the provision of basic services to the local authorities (ibid.; Von Koppen et al., 2009; Toxopeus, 2019). The constitution is anchored on a rights-based foundation that acknowledges water as a social good and aims to safeguard human dignity and equality through the provision of a lifeline supply which allows citizens to meet the minimum daily requirements of water for free (ibid.;Toxopeus, 2019). Equally, Bond and Dugard (2008) argue that a rights-based approach recognizes uneven power relations

and structural inequalities particularly salient in South Africa due to the apartheid legacy. Appendix 9 presents the sections of the Constitution that address water services and their possible interpretations. According to Dugard (2016), residents previously used protests and litigation to call the state's attention to the inadequacy and inequality in access to water services. For example, landmark case on the human right to water access, *Mazibuko vs City of Johannesburg* sought to declare the use of prepaid water meters in Phiri, Soweto (a township in the south of Johannesburg) illegal and a violation of human rights (Dugard, 2016).

In this case, the decision by the CoJ to install prepaid meters in Soweto was contested on the basis that installing the device was an infringement of the universal right to water access and was unconstitutional (ibid). The defendant argued that prepaid meters were necessary to curb the high levels of NRW (which stood at 67 %) in unmetered areas in comparison to 20% in metered areas (ibid.). Initially, the case was filed in the High Court and after a ruling in favor of the plaintiff, an appeal was filed to the Supreme Court. After the Supreme Court endorsed the ruling by the High Court, a further appeal to the Constitutional Court was filed (Dugard and Lanford, 2011). The Constitutional Court reversed the previous decision by the two courts and upheld the constitutionality of the prepaid meters since CoJ already provided FBW to the residents (ibid.). The judgement notwithstanding, there were positive socio-economic outcomes of the case such as reinforcing the rights-based model given the community mobilization on which the case had been anchored (ibid.).

Water Services Act (1998)

The Act provides strong tools and mechanisms for redressing past inequalities in water access for productive purposes for non-white South African population based on construction and maintenance of infrastructure as well as reliable provision of water services (RSA, 1998). Further, it was formulated to align with the constitution in response to calls for the integration of water-related legislation to harmonize and deepen the understanding of the key players in water issues across the value chain (ibid.). The white paper on the National Water Policy of 1997 provided guidelines that would form the backdrop of the water law (Toxopeus, 2019). Taking a pro-poor focus to water services delivery, the white paper formalized the concept of Free Basic Water (FBW) to ensure universal access to water and the need for community involvement in water services and more specifically in water projects (Beck et al., 2016). Further, the National Water Policy of 1997, Section 1 states that:

> iii) "basic water supply" means the prescribed minimum standard of water supply services necessary for the reliable supply of a sufficient quantity and quality of water to

> households, including informal households, to support life and personal hygiene (RSA, 1998).

This definition is relevant for this study as it emphasizes that the provision of water services includes supply to informal households and reveals the intention of the state to provide universal water services. However, Kemerick et al. (2011) argue that despite the law having been enacted inequalities in water access still persist and water access continue being skewed along racial lines.

In congruence with the constitution, the Water Services Act provided an institutional framework for entities that manage access to water services (RSA, 1998). The obligation for all levels of government "to ensure efficient, equitable and sustainable provision of water services is encapsulated in the preamble of the Act" (ibid.:2). These institutions include the national and provincial government, water services authorities (WSA), water service providers (WSP), water intermediaries, water boards and water services committees (see further discussions in Section 6.3.3). The Act entrusts the oversight of municipalities in the provision of water services to national and provincial governments while local authorities are mandated to deliver water services and the national and provincial governments to support local authorities (Eales, 2010). Whereas not all municipalities are WSAs, 60% of municipalities in South Africa are WSAs (ibid.).

Furthermore, the Act demarcates the authority and provider functions in water services delivery in order to ensure accountability (RSA, 1998). The water authority performs the oversight role and formulates the strategies and policies while the water provider implements the policies by providing the actual service (Beck et al., 2016). The authority "funds and builds infrastructure and sets policies as well as regulates the performance of the provider and municipalities can either provide water services themselves or outsource the provision to another entity which the municipality monitors" (Personal communication, water expert 1, 18-01-19). The WSP ensures access to water services and actual delivery of water services by operating the infrastructure and is accountable to the authority (ibid.).

Water intermediaries are organizations or people who have a secondary obligation to provide water services owing to a contract whose aim is not water provision, for instance, an agricultural holding that provides housing and other services such as water to employees living on the farm (Eales, 2011). Water boards are created by the minister of Water Affairs and Sanitation to provide bulk water services to WSPs within a stipulated jurisdiction. Currently, there are nine water boards in South Africa of which Rand Water in Gauteng, Umgeni in Kwa Zulu Natal and Overberg Water in Western Cape are the largest (Toxopeus,

2019). The minister of the Department of Water Affairs and Forestry (DWAF) can establish water services committees to provide water services in underserved or unserved areas. Although these committees are non-existent, they can provide an avenue for communities to procure water services where municipalities are unable to do so. Section 6.3.3 provides further discussions on institutions in water services in South Africa.

South African Water Policy

In 2001 the Department of Water Affairs and Forestry (DWAF) formulated the White Paper on National Water Policy for South Africa which augmented the case for equitable water services and paved the way for the FBW policy (RSA, 2001, Toxopeus, 2019). The FBW policy provided for 6 kilolitres of free water monthly per household of eight people based on the assumption of a daily minimum consumption of 25 litres of water per person (Beck et al., 2016). A JW official explained that, "the first band provides six kilolitres, the second band provides 12 kilolitres, and the highest amount is 15 kilolitres depending on the situation of the household" (Personal communication, JW official, 21-05-19). Municipalities were mandated with the implementation of the policy given that they were closer to the reality on the ground but this approach resulted in the fragmentation of the FBW provision (RSA, 2001; Toxopeus, 2019).

SERI (2018) contend that the taking away of the FBW in 2017 was a loss in the mileage previously gained in addressing inequality in access to basic services and a contravention of the right to water given that not all deserving poor people can fulfil the requirements of indigent (poor household) registration. The requirements for indigent registration include South African identification card, bank statement, South African Social Security Agency card, proof of residence and a receipt of prepaid services (ibid.). For a variety of reasons, some poor households may not have all of those documents such as utility bills if they are not formally connected to service providers and do not have a bank account as is the case of most households in informal settlements (ibid.). Further, a water consultant opined that "these registers do not work and are a means of excluding rather than including people" (Personal communication, water expert 2, 18-01-19). On the other hand, the decision to withdraw the FBW was based on the need to align with the National Water Policy which stipulates that only households registered as indigent should access FBW (ibid.).

6.3.2.1 Institutional Frameworks in Water Services in South Africa

The main institutions involved in water services in South Africa include; Department of Water and Sanitation (DWS), Rand Water Board (RWB), City of Johannesburg (CoJ) and Johannesburg Water (JW)

(see Figure 6.4). Table 6.2 indicates the sphere of government under which some of the institutions in water governance fall.

Department of Water and Sanitation (DWS)

Prior to 2014, water and sanitation affairs fell under the Department of Water Affairs and Forestry (DWAF). The DWAF was divided into the Department of Agriculture, Forestry and Fisheries and the Department of Water and Sanitation. DWS provides overall leadership for the water sector in South Africa through the formulation and implementation of water policies (Eberhard, 2012). Besides, DWS exercises stewardship over the country's water resources through the provision of licenses for water abstraction, use and disposal as well as managing the water resource infrastructure (ibid.). This separation of water resources management and water services provision is similar to Kenya (see Section 4.3.1.). DWS sets and regulates the tariff levels of water resources while aiming to recover costs of supplying raw water and subsidizing water services for poor customers such as those living in informal settlements (Personal communication, JW official, 21-05-19). Besides, given that there is no independent regulator in South Africa, DWS also functions as the regulator and monitoring agency of all the water sector institutions. Specifically, DWS owns, controls and monitors water boards such as the RWB (Eberhard, 2012).

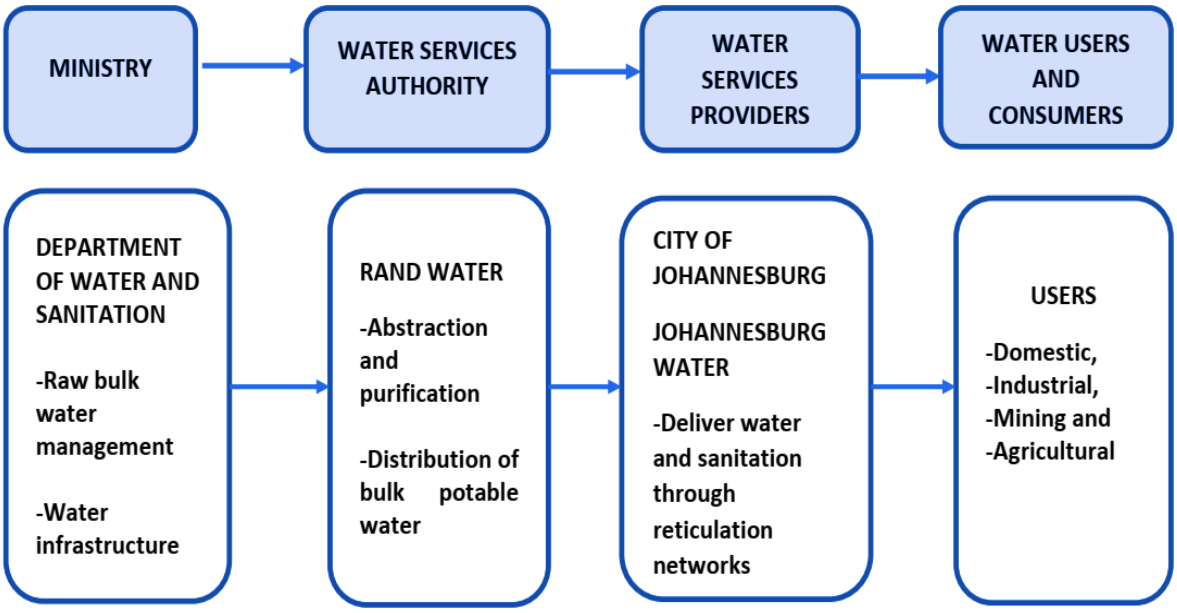

Figure 6.4: The role players in water services in South Africa

Rand Water Board

RWB was established as a company in 1903 by the Rand Water Incorporation Ordinance No. 32 to provide water services for domestic and industrial purposes to Johannesburg precincts (Rand Water,

2019). The company played a major role in the mining industry given the intensive gold mining which begun in 1886 which called for supply of large quantities of water for processing the ore (ibid.). According to DWS requirements, the company is charged with abstraction of water for commercial uses as well as sale of bulk water to Water Services Providers (WSPs) such as JW (ibid.). However, in some cases RWB plays the role of WSP on behalf of water services authorities. The company is expected to be financially solvent based on the margins of selling bulk water to metropolitan municipalities, municipalities, industries and mines (ibid.).

Over the years, the company has widened its jurisdiction outside Gauteng Province to provide water services to other provinces such as Mpumalanga, North West and Free State (Rand Water, 2017). It is estimated that RWB provides water services to more than 12 million people through a pipe network of 12,066 km (ibid.). JW buys water from RWB to distribute to the residents of Johannesburg and the relationship between JW and RWB is managed by the CoJ (Maphela, 2015). Eberhard (2012) points out that since water boards sometimes act as WSPs which are accountable to the WSA, situations of dual accountability arise whereby the boards are accountable to both the authority and the DWS thereby generating tension in the governance of boards.

Table 6.2: Government level of water services institutions in South Africa

Level	Institution	Responsibility
National	The Department of Water and Sanitation (DWS)	Formulating policy, support and regulating the water sector.
Regional/provincial	Catchment Management Agencies (CMAs)	Manage catchment areas with local communities.
	Water Boards e.g Rand Water	Management of bulk potable and bulk waste water.
	Regional Water Utilities (RWUs)	Management of regional bulk potable and bulk waste water infrastructure.
Local	Water Service Authorities (WSA) e.g City of Johannesburg	Overseeing the provision of water services within their area of jurisdiction.
	Water Service Providers (WSP) e.g Johannesburg Water	Provision of water and/or sanitation services for Municipalities.

City of Johannesburg and Johannesburg Water

In 2001, CoJ entered into a 5-year management contract with the French based company Suez Group in order to improve financial viability by infusing international best practices (Personal communication,

water expert 2, 31-01-19). Through the corporatization model, JW became a separate legal entity to gain efficiency in service delivery while simultaneously allowing state involvement in order to reduce negative social risks (Smith, 2005). Equally, the corporatization model leveraged the benefits of privatization without having to go through the lengthy and contested deliberations which characterize such decisions and as an alternative to but not necessarily a forerunner of privatization (Personal communication, water expert 2, 31-01-19). In South Africa, corporatization was implemented in the context of the 2003 Strategic Framework for water services that envisioned the universal provision of water services and charged local authorities with the balance between achieving efficiency and the equitable distribution of water (Smith, 2005). The corporatization model of JW is similar to that of NWSC in Kenya (see Section 4.2.4).

Through the iGoli model implemented in the late 1990s to resolve the administrative and financial crises through structural adjustments, CoJ took the decentralization approach which involved "ring fencing and creation of autonomous institutions known as Municipality Owned Entities (MOE) registered under the Companies Act and fully owned by the CoJ" (Personal communication, water expert, 26-01-19). This implied that the managers running the institutions had sizeable control over the revenue and costs associated with service delivery. However, the city retained substantial control over the entity's ownership and decision making but the entity oversaw the operational aspects of service provision. JW is responsible for delivering water and sanitation services in Johannesburg city within an area of 1,650 Km^2 (Smith, 2005). Interview responses from a CoJ official indicated that JW's financial performance was satisfactory since "JW is our 'cash cow' and is the best financial performer of our agencies" (Personal communication, CoJ official, 02-12-19).

There are two kinds of grants available to CoJ particularly relevant for water provision namely the Municipal Infrastructure Grant (MIG) which provides capital expenditure for infrastructure development and the Equitable Share (ES) used for recurrent expenditure (Personal communication, water expert 2, 26-01-19). The MIG is a 3-year comprehensive and conditional grant given on condition that it is used for building, upgrading and maintenance of infrastructure targeting the provision of basic services to the poor (ibid.). It is available to municipalities to cover capital expenditure for infrastructural projects that span over a financial year (Eales, 2010). On the other hand, the ES is an unconditional grant that funds the cost of ongoing service provision as well as associated recurrent costs. This grant has three components: the basic services grant which subsidizes basic services provision for the poor; capacity building grant for municipalities to acquire the human resources needed for administration; and the intergovernmental grant allocation based on the allocation of previous years (ibid.).Typically municipalities spend the funds

on “recurrent expenditure such as financing salaries thereby failing to extend service provision to the poor for instance through the FBW” (Personal communication, water expert 2, 26-01-19).

The FBW is an equity driven policy that recognizes water as a social good and a basic human right (Dugard, 2016). In order to finance the provision of FBW, municipalities rely on cross subsidization through higher tariffs for consumption beyond the FBW tariff block and the ES given to municipalities by the National Treasury (ibid.). However, the adequacy of the ES in financing FBW has been questioned given that some poor municipalities are unable to cross subsidize using higher tariffs as majority of the customers are low-income residents (Personal communication, water expert 1, 19-01-19). As previously mentioned, the FBW implementation was contested in Court in the case of *CoJ vs Mazibuko and others* (see Section 6.3.2).

As indicated in Section 6.3.2, social provision of basic services such as water therefore tends to take two approaches namely universalism and targeting. Universalism is an all-inclusive approach to service provision whereby the whole population in a jurisdiction benefits from the service (Eales, 2010). Universalism ignores the existing inequalities in South Africa based on historical, collective or personal factors. In this approach, more deserving people are treated equally as those who can afford the services (SERI, 2018). Targeting, on the other hand, is a selective approach aimed at delivering the service to more deserving people while achieving both economic efficiency and equality (ibid.). The starting point is the identification of those who fit the profile of beneficiaries and creating a profile for the target group runs the risk of excluding deserving beneficiaries on the basis of not meeting the stipulated criteria (ibid.). Additionally, there are extra administrative costs associated with the implementation of the targeted programme which prompt most municipalities to opt for universalism (Eales, 2010). However, some municipalities have a hybrid of both approaches whereby universalism is the overarching approach supplemented by a targeted approach (ibid.). A JW official explained that,

> “In 2003, JW provided all residents in the city with six kilolitres free and only paid for consumption above the FBW limit. However, in March 2017 JW changed from the approach of providing all residents in the city with FBW to the targeted method (through the Expanded Social Package, ESP) where residents who could prove that they were indigent based on stipulated criteria were provided with FBW. This made the indigent registers more exclusive than inclusive which contradicted the initial intention” (personal communication, JW official, 21-05-19).

The human rights approach prioritizes the universal provision of water to people within CoJ's jurisdiction (Dugard, 2016). Currently, JW is providing water to 87.03% of the informal settlement population although the coverage fluctuates given the fluidity and population changes in the settlement (CoJ, 2018). Documentary analysis revealed that the provision of water services by JW to informal settlements is a way of respecting human dignity (ibid.). Even though informal settlements are illegal, JW still provides water to residents based on the universal right to water access stipulated by the South African constitution. Further, in an interview a JW official indicated that:

> "We provide water to all……. in the form of a standpipe within a 200m radius for households situated on government land in line with the South Africa's Basic Water Supply Standards. For households on private land, we provide rudimentary services using subcontracted tanker trucks to refill stationary tanks in the settlements" (Personal communication, JW official 5, 24-05-19).

Another JW official expounded on the different levels of water services provision to informal settlements stating, "level 1 entails continuous supply of water through communal standpipes while nominal level service provision is intermittent and has limited access in terms of timing and quantity" (Personal communication, JW official 3, 2-05-19). The next section presents the challenges that JW faces in providing water to informal settlements.

Challenges faced by JW in the provision of water services

Firstly, the fluctuating demographics in informal settlements implies that the benchmarks used for service provision are moving targets mainly because a standard level of service provision is difficult to achieve. A state official explained that "service provision may be adequate today but as the settlement expands and becomes densified, the service you provided yesterday no longer meets the intended standard" (Personal communication, JW official 5, 24-05-19). Consequently, the residents do not access water services at the targeted level of delivery. Likewise, the organic densification of the settlement poses a challenge to the design and configuration of the hydraulic infrastructure and subsequent maintenance (ibid.).

Secondly, the fluidity and inorganic growth of the settlement further complicates the water conservation and demand management awareness campaigns which are critical for curbing water wastefulness as well as providing a platform to collect feedback. A frustrated JW official stated that "only 50% of the residents you train today will be residing in Kya Sands tomorrow since most of them rent the shacks so

they keep moving in and out" (Personal communication, JW official 6, 24-02-19). Thirdly, there exists the perception by the private landowners that the provision of water services by JW as the reason why people keep moving into an informal settlement leads to further encroachment on their land. Interview responses from a JW official revealed that "the company is cautious not to make the provision of services a stimulus for people to move into the settlement" (Personal communication, JW official 3, 2-05-19). This official further stated that "we were sued based on the fact that providing services keeps the squatters on the land" (ibid.).

During an interview, a JW official reported that residents have a strong sense of entitlement which leads them to make unreasonable expectations of the level of service provision. An official stated that, "they demand services from the state by invoking the constitution" (Personal communication, JW official 4, 19-05-19). Additionally, the residents compare the service levels provided in the settlement with that in formal areas and demand the same level of service. Another JW official reported that "the residents once told me, 'stop putting the standpipes 200 metres away, we want them in our houses like those in other places, if not, go away!'" (Personal communication, JW official 6, 24-02-19). The same official indicated that the fact that the services were free generated this sense of entitlement stating that, "whenever you do not pay for something, you neither value it nor take responsibility for it" (ibid.). Another state official reiterated saying that "there is no effort to look after the infrastructure because water is free" (Personal communication, JW official 3, 2-05-19).

6.4 CONDITIONS AND CHALLENGES OF WATER SERVICES IN KYA SANDS

This section presents broad brushstrokes of the status quo of water services in Kya Sands. It then moves on to present the conditions and challenges of water services with regard to access, use and disposal in the settlement as analysed in Table 6.1.

6.4.1 An Overview of the Water Services Situation in Kya Sands

When Kya Sands settlement began the residents procured water for domestic uses such as washing and cooking from the North Riding stream and the nearby factories. A community leader explained that "initially we struggled for water (...) we fetched it from the river. But due to many fire outbreaks, the CoJ connected water to enable us to extinguish the fires" (Personal communication, community leader 2, 18-11-2018). Moreover, the proliferation of lobbying and protests by residents led JW to supply water thrice a week through tankers located at strategic points in the settlement but water would run out before all residents accessed it. In 2007/2008, subsequent to various political interventions, JW implemented a pilot

project of installing standpipes in Section D of the settlement (see Figure 6.2). A typical standpipe in Kya Sands has 6 taps, 3 on either side of the pipe (see Figure 6.5). Interview responses from a community leader revealed that “in the beginning there were few taps and the government expanded the network (...) the intense upgrading was in 2009 before the elections” (ibid.).



Figure 6.5: A standard standpipe in Section D with six taps

Whereas Weakley (2013) study in Kya Sands found 22 standpipes, I counted 38 standpipes during the transect walks which were mapped using a mobile GIS application (see Appendix 8). The difference in number could be explained by additional standpipes that were installed in 2015. A community leader intimated that the installations in 2015 were made after protracted service delivery protests. Besides, I counted the number of functional, leaking and non-functional taps, illegal connections as well as assessing the ambience around the tap (see Appendices 8a and 8b for the summary and for the observation checklist used in the transect walks).

The functional taps are the ones from which the residents could draw water though some of them were leaking (see Figure 6.6). The non-functional taps did not produce water either because JW or the residents had closed them permanently or temporarily to stop water wastage (see Figure 6.6). Illegal connections are unofficial connections executed by some residents for domestic, agricultural or commercial uses (see Figure 6.8). Additionally, transect walks in the settlement revealed heterogeneity within and between the different sections of the settlement with regard to water access as well as the general environment around the tap. In an interview a community leader intimated that “though the taps

are unevenly distributed, the number of non-functional taps differentiates the experience of water access the farther the functional tap, the longer the walk to procure water" (Personal communication, community leader 1, 12-11-19). In the transect walks, I observed that, other than the standpipes, the rest of the reticulation systems were largely invisible in the settlement.



Figure 6.6: On the left, leaking taps at a standpipe and on the right, "an all taps" closed standpipe

6.4.2 Water Access, Use and Disposal

6.4.2.1 Water access

The supply of water services in Kya Sands is relatively reliable. Interview responses from residents indicated that they collect water throughout the day as and when they need it. Even though they do not have a predetermined time for collecting water, residents disclosed that they did not go to the standpipe at night. During the in-depth interviews and the FGD, a majority of the resident-participants revealed that security in the settlement was a major consideration in water access. A female resident disclosed that "there are thugs who attack people at the tap especially at night" (Personal communication, FGD, 24-11-18). The same resident explained that "I fetch water before 6pm during winter and 7pm in summer" (ibid.). In another interview a male resident stated that "I never go to the tap after 7 pm even if my wife is desperate…we borrow from our neighbors" (Personal communication, resident 7, 23-11-18). Further, residents reported that having tap water or yard taps would resolve the security concerns of accessing water at night. Based on informal settlements in Western Cape, Gauteng and KwaZulu-Natal in South Africa, Lagardien and Muanda (2014) noted that the history of violence and insecurity in informal settlements inhibited access to basic services for some vulnerable user groups. However, this study finds

that security was not only a concern for the most vulnerable groups such as women and children, but instead affected all residents regardless of gender or other vulnerability categorisations.

Although the residents reported that water services were reliable, some lamented that "when few taps on a standpipe are working you have to wait in the queue which takes time" (Personal communication, FGD, 24-11-18). This claim was corroborated by observations during the transect walks where I noted that some standpipes had several non-functional taps. Moreover, four standpipes in the settlement were definitely closed while on some standpipes all six taps were leaking (see Figure 6.6). Equally, the standpipes were subject to vandalism by unscrupulous residents who sold them at a nearby scrap metal yard. The finding resonated with Lagardien and Muanda (2014) study above that vandalism is a common practice in informal settlements due to the large number of users, high levels of unemployment and lack of responsibility over common resources. Interview responses from a resident revealed that "there are delays in repairing taps leading to runoffs and leaks which flood the place" (Personal communication, resident 7, 23-11-18). In an interview, a community leader disclosed that increased vandalism of the metal taps led to the installation of plastic taps even though they are less durable. Further details on the local arrangements with regard to repairs will be elaborated in Section 7.6.

Interview responses from the residents further revealed that bringing one's work to the tap was a common practice in Kya Sands as a method of accessing water (see Figure 6.9). A resident explained that, " (…) we wash clothes and dishes at the standpipe to avoid carrying the water home" (Personal communication, resident 7, 23-11-18). In the FGD, a resident intimated that, "if you do laundry near your house the walkway gets muddy due to poor drainage" (Personal communication, FGD, 24-11-18). Based on a similar study in Mumbai, India, Anand (2017) found that the practice of washing outside extended the residents' 'house space' in a manner that blurred the boundaries of private and public spaces. Equally, visibility in doing laundry in public created socially 'acceptable' female residents who were viewed as fulfilling their duties as wives or mothers.

During the transect walk through Section B, I observed several residents doing their laundry in designated laundry areas near standpipes as they engaged in conversation (see Figure 6.7). A resident explained that, "while I am at the tap washing or collecting water, I meet my neighbors. After coinciding severally, we become friends…." (Personal communication, resident 7, 23-11-18). During the FGD, a resident disclosed that, "many times I meet people at the tap and later we reach out to each other for help" (Personal communication, FGD, 24-11-18). Another resident explained that the social relations forged at the tap played a significant role in upholding the rules that govern the practices at the tap. He explained

that, “you see, it is easier to tell someone to stop doing something wrong if you already know them” (Personal communication, resident 7, 23-11-18). On the other hand, there were instances when the interactions at the tap became acrimonious. Interview responses from a community leader indicated that, “some of the disputes at the standpipes are not about water but are past unresolved conflicts that residents bring to the tap” (Personal communication, community leader 1, 2-12-18).



Figure 6.7: Two male residents washing dishes at a standpipe in Section A

Water price

As previously discussed, the residents of Kya Sands access free water (see Section 6.3.2). The argument for free basic water was captured in the Affidavit of Neil Macleod, the Head of Water and Sanitation at e-Thekwini Municipality in South Africa in the *Mazibuko v City of Johannesburg* case in 2007 that;

> “During 1998, ... it became apparent that the amount of money that was collected by the Council for the water supply was in fact equivalent to or less than the costs of administering the collection of the amounts from the relevant communities ... The Council then agreed that 200 litres per month should be supplied free of charge” (Williams, 2010:165).

Further, in an interview a key informant revealed that “there is a limit to the amount of water that one can carry from the tap because it is heavy” (Personal communication, water expert 3, 23-01-19). Interview

responses from another key informant disclosed that “water consumption by households in informal settlements is too low to warrant billing because of the expenses incurred in the process” (Personal communication, SERI expert, 08-02-19). However, provision of free water to informal settlements generated unintended consequences such as “unauthorized connections by scrupulous residents and the taps that are left running make consumption higher than 6 kiloliters” (ibid.). Figure 6.8 shows an illegal connection to a household. Section 7.2.2 presents further discussions on illegal connections in the settlement.



Figure 6.8: Illegal connection to a household in Section D

During an interview, a water expert elaborated that “not paying for water does not mean that it is free since time and energy is spent carrying it to the house” (Personal communication, water expert 2, 31-01-19). During FGDs I learnt that some community leaders made connections to their houses or businesses. A participant disclosed that “these are powerful people usually community leaders or local plumbers who use their position to connect water” (Personal communication, FGD, 24-11-18). Interview responses from a JW official revealed the attitude of the residents towards free services stating that; “people do not value the services as basic services are free and they feel entitled to receive the water” (Personal communication, JW official, 21-05-19).

Water Quality

Interview responses from the residents indicated that the quality of water was acceptable based on their perception that JW treated it. A resident disclosed that “the water from the tap looks white showing that

it has chlorine" (Personal communication, FGD, 24-11-18). However, based on conversations with residents, I realized that their definition of the quality of water included the environment around the standpipe. In an interview a female resident wondered; "how can the water be safe if the standpipe is a garbage dump?" (Personal communication, resident 15, 29-11-18) (see Figure 6.9 and photographs in Appendix 6c). Another resident indicated that, "the place around the standpipe smells and one wonders how the water can be clean" (Personal communication, resident 13, 27-11-18). Yet another resident pointed out that the behaviour of some residents around the standpipe made the quality of water questionable. She explained that "unhygienic people place their clothes including underwear on the taps" (Personal communication, FGD, 24-11-18). The concerns on quality of water is also reinforced by an encounter that I captured in my field notes during a transect walk (see Box 6.1).



Figure 6.9: The environment around a standpipe in Sections D (left) and C (right)

Box 6.1: Excerpts from the field diary, 28-11-18

As Busi and I approached a standpipe in Section E he went to the tap, opened it, cupped his left hand and drink directly from the tap. I was struck by his certainty about the quality of water. Our conversation went as follows:

Me: Are you not scared of drinking the water directly from the taps?

Busi: No, I know that it is clean as it is from JW.

Me: I would never do that in Nairobi.

Busi: Why? Isn't the water treated?

Me: It is but I cannot be sure what it comes into contact with as it is distributed in the city. I definitely would not do that.

During the transect walks and interviews with residents, I learnt that even though the water supplied by JW was treated, moving the water from the standpipe to their homes exposed the water to contamination. For instance, I noticed that the residents did not use lids to cover the jerricans but recycled plastic bags. Additionally, within the house they used cups which were left exposed to scoop water for cooking or drinking from the storage containers (see Figure 6.10). Thus, some of the practices of the residents are likely to contribute to contamination of water of otherwise high quality.



Figure 6.10: A cup used to scoop from a jerrican in a house in section D

6.4.2.2 Water uses

During the interviews and FGDs, the residents of Kya Sands disclosed that water is mainly used for domestic purposes such as cooking, bathing and cleaning. Since the prevalent type of sanitation in the settlement is chemical toilets or Ventilated Improved Pit (VIP) latrines, the amounts of water required for sanitation (such as flashing of toilets, or cleaning after use) are relatively low. Interview responses from residents indicated that a majority of households did laundry once a week except for households with young children or infants where laundry was more frequent. It was interesting to note as in the case of Mukuru, households in Kya Sands consumed an average 80 litres (4 x 20-litre jerricans) daily. Nonetheless, water usage varied with the day of the week and the season of the year. For example, a resident pointed out that “on weekends and school holidays we use more water” (Personal communication, FGD, 24-11-18) while another reported that “in summer the children bath twice daily” (Personal communication, resident 16, 29-11-18). Although the water in Kya Sands is free and the supply

is reliable, residents conserved water since it is heavy and has to be ferried from the water point to the house.

Interview responses also indicated that water was used for religious practices such as ablutions and cleansing. During interviews residents who belonged to the Zion Christian Church reported that in the past the initiation rites were performed in the Jukskei (North Riding) River (see Figure 6.1). A resident expounded that "previously we used water from the river but now we get it from the standpipes and dispense it to the worshippers for purification and to dispel evil spirits" (Personal communication, resident 19, 23-11-18). After some rituals that entailed blessing the water, the members of the church believed that it had cleansing properties. Another resident emphatically stated that "we now use tap water because the filthy state of the river indicates that God cannot be present there since cleanliness is godliness" (Personal communication resident 13, 27-11-18).



Figure 6.11: The aftermath of a fire in Kya Sands Section A

Besides, water was critical in putting out the frequent fires that break out in the settlement. In the course of my fieldwork, a fire broke out in Section A and razed a house to the ground (see Figure 6.11). The residents put out the fire using water from a nearby standpipe. Fires spread fast in informal settlements due to the high density of the houses and the inaccessibility to the scene by residents or fire fighters. Additionally, in the transect walks, I learnt that some residents practiced urban agriculture either through domestic or communal gardens. During the transect walks I observed that privately-owned domestic

gardens were located within a stand or the curtilage of the dwelling while communal gardens were collectively cultivated by residents at the margins of the settlement. The size of domestic gardens varied from a number of potted plants or flowers to a few square feet on the ground (see Figure 6.12). I observed that the size depended on whether or not the gardens were located on an individual stand and that in most cases, houses situated on demarcated stands had domestic gardens and were larger than those that did not have demarcated stands. The residents pointed out that they used water from standpipes to irrigate the domestic gardens. I enquired if water from the Jukskei river or grey water was reused or for irrigation. A resident explained that "water from the river is too filthy to feed plants and the water used to wash dishes or clothes contains chemicals harmful for human consumption" (Personal communication, resident 16, 29-11-18).



Figure 6.12: A domestic garden situated in a demarcated stand in Section C

During the FGD a resident explained that grey water sometimes had solid food waste which attracted rodents particularly rats into their houses. During an interview with a community leader, I enquired why the residents engaged in urban agriculture. He pointed out that, "plants and flowers beautify the stands and the food is for subsistence purposes" (Personal communication, community leader 1, 12-11-19). Interview responses from residents indicated that they did not entirely rely on domestic gardens to meet their dietary requirements but were only a supplementary source of food. This finding concurred with those of van Averberke et al. (2007) and Olumuyiwa (2016) on informal settlements in Pretoria and Kya

Sands respectively where the contribution of the produce to the household consumption was meagre (about 6.7% of the monthly recommended vegetable intake).

During transect walks, I observed two communal gardens in the settlement. The first one was a greenhouse run by a community group formed in order to address issues of food security (see Figure 6.13). The group had made a water connection from a nearby standpipe to irrigate the crops. During the FGD, the residents indicated that, "the produce from the greenhouse is not sold but subdivided among the group members" (Personal communication, FGD, 24-11-18).



Figure 6.13: A greenhouse located in Section E near Agnes Road



Figure 6.14: A communal garden in Section D

The other one was a communal garden cultivated by residents who were allocated individual plots by the committee for agricultural purposes (see Figure 6.14). During the transect walk, the chairman of the settlement committee intimated that the committee was keen on the residents farming on the plot so as to curb encroachment by would-be residents. I observed that the residents planted maize, cabbage and beetroot among other vegetables. Although the farming in the communal garden was largely for subsistence, a few residents sold the produce. A resident revealed that, “the proceeds are meagre and you hardly get much from selling the vegetables” (Personal communication, resident 13, 27-11-18). Further, I observed that the communal garden had a dedicated water pipe connected from a nearby standpipe but executed through an illegal connection. Equally, during the interviews the residents who own cars reported that they used water from the standpipes to clean the cars either by driving the car to the standpipe or connecting a pipe from the stand to where the car was parked. Besides, I observed that public transport vehicles (*taxis)* on Agnes Road in Section E were washed near a standpipe where a plastic pipe was connected to the car wash area (see Figure 6.15).



Figure 6.15: A car wash situated next to a standpipe in Section E on Agnes Road

6.4.2.3 Water disposal

During the interviews and FGD, the residents concurred on the inadequacy of wastewater disposal infrastructure and the resultant negative impacts on the settlement (see Appendix 6a on wastewater disposal). I observed wastewater runs through the streets forming gullies as it proceeded to the North Riding stream (see Figure 6.16). Moreover, foul smelling stagnant pools of water were observed

especially around the toilets (see Figure 6.17). In an interview, a resident expressed her concern stating that "the puddles are a hazard because children play in them and the water is dirty" (Personal communication, resident 12, 27-11-18). Another resident expounded that "…this place is always wet and smelly and no one knows where the water comes from……If I had money I would move out of here and go to Cosmo City… at least things there work and I can flash my toilet" (Personal communication, resident 14, 27-11-18). This assertion indicates that the residents aspired for a better life but the lack of finances generated a sense of helplessness about their situation.



Figure 6.16: Jerry rigged wastewater tunnel emptying in Jukskei River in Section A



Figure 6.17: Poor waste-water disposal next to chemical toilets in Section D

The drainage problem was further exacerbated by the constant runoff caused by leaking taps and pipes (see Figure 6.18). For example, Section B had a burst pipe which as the residents explained had been leaking for the last three months. The residents further stated that although JW had visited the site in several instances, the problem had not yet been fixed. During the FGD, the residents revealed that water disposal and the drainage system in the settlement was a salient topic in the community meetings. The residents improvised or jerry-rigged drainage systems to the wastewater into the river to ensure that the walkways remained navigable. Further, the drainage diverted leaks from the standpipes as well as avoided wastewater runoffs into the houses. However, residents who live close to the Jukskei river dispose off wastewater directly into the river as shown in Figure 6.16.



Figure 6.18: A burst wastewater pipe in Section B

Additionally, the mode of water disposal depended on the time of day and the amount of wastewater to be disposed. During the day, residents sprinkled small amounts of wastewater along the walkways while they disposed larger amounts in an open trench or at the standpipe (see Figure 6.19). The residents further elaborated that, “sometimes we have backflows of wastewater into our houses, so we dispose it farther from the houses to avoid this happening” (Personal communication, resident 17, 27-11-18). Interview responses indicated that residents were unwilling to participate in solving the wastewater drainage system. During the FGD, a male resident explained that, “I pay taxes so the government should deal with it” (FGD, resident, Kya Sands). Another resident indicated that, “since we do not know each

other there is little cooperation" (Personal communication, resident 12, 27-11-18). This finding was corroborated in an interview with the chairman of the settlement committee who said that, "our efforts to mobilize residents to participate have failed because we hardly do things together as a community" (Personal communication, community leader 1, 12-11-19).

In an interview, a resident complained that, "inadequate security causes people to use buckets as toilets at night and to accumulate wastewater and dispose it in the morning. The smell of the human waste is the problem" (Personal communication, resident 12, 27-11-18). Bucket toilets (the most common system in the apartheid regime and still much detested) continue to be prevalent in South African settlements in spite of the 2003 Strategic Framework for Water Services aiming at their eradication by 2007 (Eales, 2009). The use of bucket toilets at night was prevalent in the entire settlement though it was particularly salient in Section B. This was also because the chemical toilets which are located far from the houses are not regularly serviced while the long distance to the toilet and the poor outdoor lighting exposed the residents to crime.



Figure 6.19: A resident sprinkling wastewater on the walkway in Section C (left) and a resident disposing accumulated wastewater at a standpipe in Section D (right)



Figure 6.20: Mats used to absorb wastewater overflow in Section A

Further discussions with the residents revealed that water disposal issues were the primary cause of interhousehold conflicts. A resident protested saying that, “when the residents living in the higher parts of the settlements dispose of wastewater (also with human waste), it flows down into our houses and when you tell them to stop quarrels begin” (Personal communication, resident 9, 27-11-18). Interview responses from residents indicated that within the household wastewater disposal was mainly the task of a mother. A married female respondent reported that given the age of her children, she was responsible for disposing off wastewater in the open trench. Nevertheless, some residents revealed that wastewater was disposed of by whoever in the household generated it. A male respondent intimated that “in this house whoever uses it, discards it” (Personal communication, resident 14, 27-11-18).

Finally, during the transect walks, I enquired about the walkways lined with old carpets and mats (see Figure 6.19). Gugu, my guide explained that, “they absorb overflows and backflows from the drainage to keep the streets passable” (Personal communication, Gugu, 13-11-2018). Moreover, residents living in houses located in flood-prone areas created barriers such as plastic crates filled with stones or sacks filled with soil to prevent wastewater and rainwater from flowing into their houses (see Figure 6.20 and 6.21). In Section A, a resident living close to the Jukskei river revealed that, “during heavy rains, the river floods our houses” (Personal communication, Resident 9, 23-11-2018). These findings indicate that the

residents need to engage and practice coping strategies to deal with inadequate wastewater disposal as well as rain and storm water flows.



Figure 6.21: Plastic crates used to hold back floods and wastewater in Section A

6.5 INITIAL REFLECTIONS ON THE CONDITIONS AND CHALLENGES OF WATER SERVICES IN KYA SANDS

This chapter demonstrates how the legacy of the apartheid regime dominates the current water situation in South Africa as well as in the case study settlement. Various legislations in South Africa provide the state with strong tools and mechanisms to redress the inequalities that emerged from the apartheid regime. However, even after two decades subsequent to the enactment of the legislation seeking to redress historical injustices of Apartheid system, access to water services in South Africa is still stratified along racial lines. Water services in Kya Sands are provided by JW as part of the FBW policy. The chapter also reveals the coexistence and interaction of laws and ordinances that govern water services and how the plurality of the legal frameworks extends the understanding of rights to water in a particular social context (Kemerick et al., 2011). Additionally, in order to negotiate access to water, actors often depend on different laws and ordinances to support their claims. Furthermore, the chapter shows that the laws and policies that recognize water as a constitutional right are insufficient to ensure access to water and the residents need to employ non-normative modes of governance such as negotiations, maneuvers and contestations to access water services.

Further, the chapter demonstrates how practices of the state render some aspects of water services invisible or visible at different points in time (Razon, 2017). The state selectively 'sees' some of the aspects of water services while it ignores some to avoid the intensity and complexity of the problems. For example, paying attention to illegal connections used for urban agriculture could lead to settlement-wide protests that could spill-over to neighboring settlements. What and why does the state choose to see or not to see? I argue that what is not seen has power dynamics which may render it invisible as is the case with the illegal connections whereby JW obscures the problem to avoid resistance from the residents. Visibility signals recognition of the 'seen' problem which could open doors to its monitoring and inclusion of the residents towards resolving the problem.

The residents have heterogeneous experiences of access to water services given the uneven distribution of the standpipes in the settlement. Standpipes are a critical point of human interactions, thus demonstrating a combination as a social space as well as material infrastructure. This indicates the mutual co-constitution of material infrastructure and people-as-infrastructure in the access to water services. Whereas water supply is reliable, wastewater disposal is problematic thus presenting environmental as well as health hazards for the residents. The lack of wastewater infrastructure seems invisible to the state and therefore is not prioritized given the complexity of resolving the problem, especially within an informal settlement context where diverse actors would have to be engaged in the process. Furthermore, although water services provision is reliable, other services such as security and sanitation significantly affect the ease of gaining and maintaining access by the residents. For example, from the interviews, sanitation services in Kya Sands influence the practices of wastewater disposal such as residents emptying their sanitation bucket onto the street or open drains in the settlement.

Residents rely on social relations to gain and maintain water access in the settlement. The interactions of the residents at the tap, both on the queue or bringing work to the tap, generate social networks among the residents which are useful for access to water services as well as other basic services. Besides, these social relations are important in generating the social pressure required to ensure that the residents adhere to the norms and rules around the tap. In line with the notion of doxa by Bourdieu (1984) as reviewed in Section 2.6, the power dynamics between the various actors is manifest in how the actors navigate rules in their favour by creating spaces for (re)negotiated access to water services. However, while social relations are crucial in gaining and maintaining access to water services, they contribute to inequalities in access thus deepening the vulnerabilities of already vulnerable residents. Besides, the poor condition of wastewater disposal causes interhousehold conflicts especially when wastewater flows into people's houses.

CHAPTER SEVEN

7 ACTORS AND THEIR PRACTICES IN THE GOVERNANCE OF WATER SERVICES IN KYA SANDS

7.1 INTRODUCTION

Cognizant of the overall research question, this chapter addresses the second and third sub-questions on the actors, their roles and practices in the provision of water services in the informal settlements. Examining actors also reveals the power struggles and dynamics since access to water services entails a continuous process of negotiation among various actors. It is during the negotiations that various actors put forward the 'logics of practices' that shape the outcomes of the process. The actors are broadly categorized as state and non-state actors based on their alignment with the state. The chapter begins by presenting the state and non-state actors in water services in Kya Sands and their practices of gaining, maintaining and denying access to water services. Data presentation and analyses for the second and third sub-questions for the Kya Sands case study are similar to the Mukuru case (see Section 5.1) The data coding matrix is presented in Table 7.1.

The chapter demonstrates that water governance in Kya Sands is a hybrid of formal and informal practices where, although the state plays a significant role in provision of water services, the non-state actors such as the settlement committee influence decisions on water services. Equally, the chapter shows that over time the knowledge acquired by the residents about the hydraulic reticulation allows them to implement repairs by themselves. However, although the infrastructural knowledge at the local level is less blurred, it is also highly fragmented and personalised which makes it difficult to produce a coherent system of repairs. In order to access water services, residents navigate the settlement through informal practices ranging from coping practices of dealing with inadequate water services to the repair of the infrastructure. Knowledge generated about water is the product of a complex combination of power relations and the interests of actors. Similarly, the role of social relations and people as infrastructure in mediating access to water services is highlighted throughout the chapter.

Additionally, the chapter shows how the intersections between state and non-state actors generate complex layers of the governance of water services. Using Caldeira's (2017) idea of transversal logics, this chapter demonstrates the relationship between the residents and the informality of the state. Given that the actors have unequal power, the processes of contestation and negotiation lead to incremental and uneven transformation of practices of access to water services. Hence access to water services

involves multiple strategies, tactics and maneuvers which are constantly reconfigured. The practices of water access often involve interactions between state and non-state actors in ways that transverse the official logics (ibid.). Furthermore, the residents do not upset the official logics by contesting them directly but by working through them transversally. Finally, the chapter reveals conflict in the "rationality of governing and rationality of survival" that arises during the provision of water services (Watson, 2009:2268).

7.2 STATE ACTORS IN KYA SANDS

Section 6.3.3 presented the main state institutions involved in water services provision in South Africa as well as their powers and functions. The institutions discussed were Department of Water Affairs and Forestry (DWAF), Rand Water Board (RWB), City of Johannesburg and (CoJ) and Johannesburg Water (JW) (see Table 6.2 for the government level of these institutions). Based on the data coding matrix presented in Table 7.1, this section presents the other state actors namely the political party representatives and ward councilors who are community leaders and politically elected leaders respectively.

7.2.1 Political Party Representatives and Ward Councilors

Political party representatives are community leaders residing in the settlement who are appointed as agents of political parties to create political networks and to distribute "party benefits" to residents. Interview responses from residents indicated that party politics was critical in gaining and maintaining access to water services. In Kya Sands the two main political leaders are: Mr. Billy Modikwe, the African National Congress (ANC) representative and Ms. Ma'am Sdudla, the Democratic Alliance (DA) representative. During the FGD, a resident stated that "Billy is powerful since he gets JW to reconnect water quickly" (Personal communication, FGD, 25-11-18). In an interview, Ms. Ma'am Sdudla explained that "when there is no water or a pipe bursts in section C, I call JW to repair and they arrive quickly" (Personal communication, Ms. Ma'am Sdudla, 14-12-18). This finding coincides with Benit- Gbaffou et al. (2013) study of several African cities (among them Johannesburg and Nairobi) where the local political party structure gets things done faster and better than the bureaucracy of local governments and the presence of political parties in the everyday lives of citizens gives the parties social control manifested through diverse ways in the informal settlements such as enabling service provision.

Table 7.1: The actors, their roles and practices in water services in Kya Sands

Data instrument	Sub-theme	Focus group discussions and Semi-structured interviews	Key informant interviews	Transect walks and direct observation	Secondary sources
THEME: State actors	National level Roles and practices	National government	Levels of state actors: national, regional or local	No observation	-Levels of state actors: national, regional or local. -CoJ (2007) report
	Regional level Roles and practices	-JW: provide water and maintain the standpipes. -CoJ: building, upgrading and maintaining infrastructure-	-JW owned and monitored by CoJ -CoJ ensures adequate service provision.	No observation	-Weakley (2013) on the resilience of Kya Sands -Olumuyiwa (2016) on just sustainability on Kya Sands.
	Local level Roles and practices	-Political party representatives and ward councillors- mediators between residents and JW.	-Political party representatives and ward councillors. -Reporting water problems. -Communication about temporary water disconnections.	-Residents pointed out the ward councillor's house in the settlement.	-Weakley (2013) on the resilience of Kya Sands. -Benit-Gbaffou et al. (2013).
	Practices for granting and maintaining access	-Installation of JW standpipes -Water tankers to deliver water services. -Few water tanks.	JW installs standpipes and a few water tanks. -Water trucks deliver water	-Photographs of standpipes. See Figure 6.5.	-Weakley (2013) on the resilience of Kya Sands.
	Practices for denial of access	-State officials ignore illegal connections.	-State officials do nothing to wrongdoers.	- Several illegal connections. -Mode of payment to the local plumber.	-Berk and Galvan (2013) political creativity. -Benevides (1995) Role of silence in the water scarcity narrative.

		- Committee requests JW for total disconnection.	-Wastage of water by taps running. -Toyi-toying to get service delivery.	-Illegal connections at standpipes See Figure 6.8. -Counted 4 permanently closed standpipes. See Figure 6.20	-Misra (2014) Suspension of formal rules to allow for manoeuvre. -South African Water Policy
		-Temporary disconnection for repair by JW. - Residents unaware of the rationing schedules. -Language barriers for migrant residents.	-Communication through ward councillors and the committee -Water rationing schedules on the company website	-Announcements in IsiZulu made using portable loudspeakers.	-South African Water Policy
THEME: Non-state vendors	Settlement committee	-Role of social-economic status in being elected. -Lack of transparency in the elections. -Internal wrangles in the committee.	-Established voting system. -Role of the committee in provision of water services.	Water points throughout the settlement	-Benit-Gbaffou and Katsaura (2014) Yeoville, Johannesburg -Weinstein (2008) Mumbai, India.
	Kya Sands community	-Meanings attribute to water by the community and the practices from those beliefs. -The impact of migrant status on access and voice.	-The impact of the meanings of water and willingness to pay.	-The meanings of wate vs the state of the Jukskei River. -Children playing with clean water. -Lack of awareness of source of water by residents.	-Linton (2010) on the meanings of water.

	Gender dynamics	-Women are responsible for procuring water. -Women distribute household water household.	-Women on the settlement committee.	-Women at the standpipes fetching water. -Women carrying jerricans of water.	-Harries et al. (2016) intersections beyond male-female binary.
	Practices of residents	-Coping mechanisms. -Lack of water storage due to reliability of water supply.	-Water shortage is short lived.	-Lack of storage tanks around the settlement.	-Peloso (2014) Accra, Ghana
		-Water gifts Borrowing water from Bloubosrand, factories and neighbours. -Reciprocity in water gifting	-Bloubosrand residents fetch water from Kya Sands. -Residents work in the factories and homes in Bloubosrand.	-Proximity of Kya Sands and Bloubosrand makes gifting possible.	-Zug (2014): economic, spatial and social elements of water gifts. -Zug and Graefe (2014)
		Mobilization of funds to buy new taps for repairs. -Committee uses money for personal gain. -Rudimentary repairs by residents. -Ethnic diversity inhibits protests.	-JW leaves spare taps with residents.	-Rudimentary repairs -Illegal connection to the local plumber's house.	-Anand (2015): Leaky states in Mumbai, India.
		-Resistance to and lack of awareness of the rules.	Residents change cumbersome rules. -Lack of sanctions for non-compliance.	Residents engaging in prohibited activities such as indiscriminate disposal of waste.	-Simone (2015) -Bourdieu (1999)

In an interview, a CoJ official explained that "dealing with political parties can be messy because if I communicate with someone affiliated to one party or if service provision is improved in a section of the settlement people perceive it as favoritism." (Personal communication, CoJ official 1, 17-01-19). Another CoJ official stated that "everything done in settlement is read through a party lens" (Personal communication, CoJ official 2, 20-01-19). This same official further explained that "interparty and intraparty conflicts further complicate things since you have different narratives of the problem even in the same party" (ibid.). This comment suggests that through their involvement in neighborhood issues, political parties create a vote bank through real and perceived efforts to provide services although their main goal is competition not efficiency. This finding which contrasts the situation in Mukuru where the vote bank phenomenon is not at play, could be explained by the emphasis of the African National Congress (ANC) party loyalty in South Africa.

Finally, the diversity in political affiliation among the settlement committee members influences how community issues are resolved since members represent their party-political interests. Equally, the residents intimated the fragility of ward councilor's political capital stating that, "they hop parties at their political convenience, so we doubt their intentions and find them unreliable" (resident, FGD, 26-11-18). In an interview, a community leader explained that "as the government channels money to the councilor, you must speak to him if you want a job or another favour" (Personal communication, community leader 1, 12-11-18). This finding is congruent with Benit-Gbaffou et al. (2013) study of the role of party politics in 18 African cities (where political parties depend on people's social connectedness to include or exclude them from access to resources based on their outward manifestations of loyalty both within and outside election periods.

Interview responses from a CoJ official indicated that,

> "ward councilors are elected members of the local government who represent residents of a local authority area and have dual accountability to the electorate and the local government. They need to be responsive to the people they represent while at the same time providing the local authorities with information for decisions about their wards. They have a better understanding of the problems faced by the electorate and are accessible to the electorate as they live with them" (Personal communication, CoJ official, 22-01-19).

Equally, residents feel entitled to service delivery because they voted for the ward councilor and expect enhanced provision of basic services. Interview responses from residents revealed that the ward councilors in Kya Sands play a key role in enabling access to water services through their mediatory role between the residents and JW. A resident elaborated that "our councilor Matome manages the standpipes and checks if taps are stolen or broken and tells us about new policies and other pertinent information from JW with regard to water services provision in the settlement" (Personal communication, Kya Sands resident 5, 19-11-18).

During the FGD, residents intimated that they had varying levels of trust in the ability of the ward councilors to make changes in the settlement. A resident complained that "councilors are just politicians who give empty promises and nothing gets done because they are looking for votes" (Personal communication, FGD, 22-11-18). In discussing the willingness of residents to pay for improved service provision, a resident categorically stated that "I can only pay if it is a Democratic Alliance (DA) party councilor or the previous DA councilor John Mendelsohn who was efficient and trustworthy" (ibid.). Based on conversations with residents I realized that party affiliation and proximity to power and resources played a big role in the election and effectiveness of ward councilors in executing their duties. In an interview, a JW official explained that "it is important though difficult that councilors remain impartial and serve the needs of all the residents regardless of their party membership" (Personal communication, JW official 3, 2-05-19). Effectively, ward councilors have to maintain the delicate balance of serving all the residents in the informal settlement and creating a vote bank for their respective political parties.

7.2.2 State Practices

I now move on to examine the practices of the state (also see Sections 6.3.2.1, 7.2.2 and Table 7.1) with regard to enabling, maintaining and denial of access to water services.

7.2.2.1 Practices for enabling and maintaining access to water services

JW uses material infrastructure to enable, maintain and deny access to water services to the residents of Kya Sands. The New Services Department (NSD) installs the technical hydraulic infrastructure and after completion hands it over to the operations department to supply water services (Personal communication, JW official 5, 24-05-19). The location, land ownership and the layout of the settlement influence the type of infrastructure and whether JW will provide rudimentary or nominal services. Once the NSD has installed the infrastructure, the operations department is responsible for the maintenance. Further as shown in Figure 6.5, the reticulation of water to Kya Sands is connected to that of Bloubosrand

and Kya Sands Industrial area which ensures that the quality of water supplied to the informal settlement is the same as that supplied to the formal precincts (ibid.).

In addition to the routine wear and tear of the infrastructure, vandalism of the taps is the most common reason for repairs in Kya Sands. In a conversation during a transect walk through Section D, a community leader disclosed that "subsequent phases of standpipe installation have used plastic taps due to vandalism, but they break easily" (Personal communication, community leader 1, 12-11-18). Similarly, a state official explained that: "… we proactively make impromptu visits to check and fix the taps on the standpipes" (Personal communication, JW official 4, 19-05-2019). In an interview a JW official explained the process of repairs and maintenance of infrastructure in Kya Sands saying that;

> "Firstly, people report water problems to the ward councilors who in turn inform JW (…) also we have the onsite inspectors who besides ensuring that the service provider (we outsource services) is working according to the contract, report any problems on site. He could say, 'hey, standpipe number 123 is leaking' so they lock it through that process. The third method is (…) to proactively go to every standpipe in the informal settlement to check and we send a guy to fix it. We rotate through the informal settlements because it is difficult for people to report repairs to us" (Personal communication, JW official 3, 02-05-2019).

However, interview responses by a community leader contradicted the views from the JW official. He disclosed that, "as the committee we go around the settlement to inspect the standpipes and JW employees only come when we report a problem (…) but even then it takes long to get repairs done" (Personal communication, community leader 1, 12-11-18). This contradiction between the accounts of the JW official and the community leader probably reflects the contestation between various actors where each would like to be perceived as more powerful and relevant than the others.

7.2.2.2 Denial of Access

Interview responses from JW and community leaders indicated that the company disconnects water supply to standpipes when residents have ignored repeated warnings both from the community leaders and JW about wasting water. A community leader explained that, "…if taps are left running, warnings are issued and if the situation continues, the standpipe is permanently closed by JW so they walk to other standpipes where they might queue to collect water" (Personal communication, community leader 1, 18-11-18). This statement was corroborated by a JW official who disclosed that "(...) the committee calls us

to block the standpipe permanently when the residents waste water or leave the taps running" (Personal communication, JW official 7, 16-05-19). This practice by JW impinges the legal requirement by the South African Water Standards of the 200m proximity to water access by residents. Similarly, the residents have to stand in line to procure water and use their bodies to carry the water to their houses which further demonstrates the 'people-as-infrastructure' element of my argument. Based on the transect walks, I counted 4 permanently closed standpipes as shown in Figure 7.1 and Appendix 6A.

In elaborating on the process of repairs and maintenance of infrastructure in the settlement, a JW official showed how the non-linear nature of governance decisions may be driven by the need to balance the interests of different actors,

> "…since illegal connections leak, we used to eliminate them, but this created resistance. You remove them today and tomorrow residents reconnect them which is not cost-effective (...), we just ignore them. Again, political sensitivities cause people to resist and they start burning the municipal buses (…) because you are taking away this illegal service, I am going to burn your clinics, the schools, or the public transport (…) also when people are *toyi toying* in one settlement it usually spreads over to other settlements and you just do not want that. In Kya Sands, they spread over to the factories across the road, putting businesses there and these people's livelihoods at risk. It is not that straightforward." (Personal communication, JW official 7, 16-05-2019).

In line with my argument on visibility, the residents seem to employ toyi toying as a tactic to make themselves visible to the state. Toyi toying is a high-stepping dance and simultaneous chants typically performed in protests in South Africa. Further, these views demonstrate how the rationality of the state is bounded and as a result, decisions are not based on full information on how the residents perceive a problem or how they will react. The inaction of the state renders the illegal connections invisible possibly based on the need to avoid the sensitivity and intensity of the problem. Equally, as the problem remains unseen by state officials, it ceases to be a priority in the concerns of the utility.



Figure 7.1: A disconnected standpipe in Section D

JW communicates information such as foreseen and unforeseen water supply interruptions and infrastructure break downs to its stakeholders through social media, the company website, radio and print media. Through mediated engagements, JW communicates with the ward councilor or the committee members by a weekly phone call to enquire about the standard level of service provided. However, interview responses from residents showed that JW communicated about possible water cuts beforehand. However, residents had different experiences with regard to the communication from the committee. In an interview, a resident intimated that "the committee informs us when there is a water cut due to repairs by JW" (Personal communication, resident 7, 23-11-18). In an FGD, I enquired how the announcements were made. A resident said that, "usually someone goes around the streets with a loudspeaker" (Personal communication, FGD, 24-11-18). Residents indicated that they relied on their social networks to know about water interruptions. A non-South African respondent intimated that "I cannot speak Sepedi or isiZulu so I miss out on the announcements but my neighbours inform me about the water cuts (Personal communication, resident 20, 15-12-18). Another resident complained that "I am at work when the announcements are made and do not get to know when there is no water, so I depend on my neighbours to stay informed" (Personal communication, resident 17, 13-12-18). This finding relates to Bourdieu's work on social capital in access to resources as discussed in Chapter 2.

7.3 NON-STATE ACTORS IN KYA SANDS

While not being part of the state, non-state actors influence water governance decisions by the state. Examining non-state actors is useful in thinking about water governance outside the confines of the state.

This section looks at the non-state actors in Kya Sands as analysed and summarised in Table 7.1. They include the settlement committee and the Kya Sands community.

7.3.1 Settlement Committee

The settlement committee is a major player in basic services provision in the settlement (see discussions in Section 6.2). Interview responses from residents and community leaders demonstrated conflicting views on whether the committee members are democratically elected. A community leader stated that "there is a clear system of elections and residents vote for whoever they want" (Personal communication, community leader 1, 12-11-18). In the FGD, a participant complained that "we know nothing about elections we are just told that there is a new committee" (resident, FGD, 26-11-18). This report of the FGD participant endorses the findings of Benit- Gbaffou and Katsaura (2014) study of community security governance in Yeoville, Johannesburg that community leaders were neither formally elected nor had clearly defined leadership roles and mandate. In the same FGD, another resident revealed how socio-economic status played a role in community leaders' elections stating that "those with money join the committee….. most are either landlords or businessmen here" (resident, FGD, 26-11-18).

Interview responses from residents indicated that the legitimacy of some of the committee members and the committee as a whole was contested. In an interview, a resident explained that the elections were irregular saying that, "elections are by show of hands (…) the day, time and venue is unclear" (Personal communication, Kya Sands resident 19, 23- 11-18). Another resident stated that "these are not my leaders (…) some members have adopted the "Mugabe" system of wanting to stay in power because of the economic benefits that they derive from it" (Personal communication, resident 20, 1-12-18). During the FGD, a resident stated that "the affairs of the committee are not black and white (…) they have no office and there is infighting among the members". (Resident, FGD, 26-11-18). However, in a conversation the committee chairman stated that "we do not receive any remuneration though there could be fringe benefits like access to employment in the future. We are elected based on our track record and sense of commitment" (Personal communication, community leader 1, 12-11-18). These findings support my argument of the role of power relations in the provision of basic services as discussed in Chapter 2.

Responses from key informants and residents showed that despite its legitimacy being questioned, the committee plays a crucial role in land allocation and provision of water services. In an interview the chairman of the committee explained that the committee monitors the standpipes and ensures that residents follow the rules at the standpipes. He succinctly summarized the role of the committee as:

> "…overseeing the way of life of the settlement in terms of deciding where and when the shacks are built as well as the development of the whole settlement. Otherwise you lose control of the settlement and it becomes unmanageable for instance people build on manholes which blocks the drainage. We also resolve conflicts between residents in collaboration with the police. We are go-betweens of the residents and the government (…) we formulate the rules and norms regulating behavior at the standpipes and wastewater disposal" (Personal communication, community leader 1, 2-12-18).

This finding resonates with Benit-Gbaffou and Katsaura (2014:1813) study in Yeoville, Johannesburg, that community leaders are mediators "situated agents, between structural constraints (rules and norms framed by both the state and the community) and individual agency (consisting partly in iterative interpretation of contexts and the results of their own actions therein)".

7.3.2 Kya Sands Community

Section 6.2 presented discussions on the demographics of the Kya Sands community. This section will focus on the meanings that residents attribute to water and role of gender dynamics in the governance of water services in the settlement. Interview responses from the residents about the source of water showed the cultural representations and in particular, their views of water as coming from God and therefore it is abundant and if it goes away it will always 'come back'. Additionally, the residents argue that water should be free because God gives it. A CoJ official reported the views from a previous community meeting stating, "water comes from God why should we pay for it?" (Personal communication, CoJ official 2, 19-01-19). During the FGD a resident revealed that, "water is always available because God lives in water and he is always there" (Resident 2, FGD, 27-11-19). In the same FGD, another resident interjected saying, "God is powerful, so water supply is infinite" (Resident 4, FGD, 27-11-19). Similarly, in a study of water services infrastructure in Cape Town, South Africa, Rodina and Harris (2016) found that residents who had unmediated access to water through rivers and wells considered water a natural resource and a 'gift of God' which should be accessed without payment.

However, I noted a contradiction in the fact that the Jukskei River which passes through the settlement is highly polluted given that some residents indiscriminately disposed of solid waste and wastewater in the river, yet they believed that God lives in water. As discussed in Section 6.4.2, water is used by members of various religions to denote cleansing from evil spirits and sins. For instance, the Muslims, use water for ablutions to prepare for their devotional practices while for the Zion Christian Church, water

is used for baptism to cleanse sins. Thus, scarcity of water caused tension for religious practices as it interfered with the preparations for engaging in worship.

During the transect walks, I observed children playing with clean water and no one seemed to care about the numerous leaks in the settlement (see Figure 3.3). I asked a JW official the reason behind the wastage of water. He explained that it was largely due to ignorance of what it entails to treat and supply potable water to the settlement (Personal communication, JW official 3, 21-5-19). Further, conversations with residents indicated the ignorance of the process of water abstraction, treatment and supply to the settlement which led them to engage in wasteful practices such as using water pressure at the tap to do their laundry. During an interview, a resident pointed out that "water comes from Lesotho, but I do not know how they get it here" (Personal communication, resident 6, 14-11-18). In the same vein, a state official explained that "we need to educate people because they think that it just rains and we have water" **(**Personal communication, JW official 3, 21-5-19). Another state official elaborated the effect of this perception on practices saying that,

> "-- our god, Mwari resides in water so we praise him. … when you tell people, 'Please conserve water!' Will they take you seriously? For them water is abundant, if you pray, it rains……. If kids play splashing water, they think that they are praising their god [laughter]. It is culture" (Personal communication, JW official 2, 21-5-19).

The discussions above demonstrate how the different meanings of water by actors affect their practices with regard to water services. Besides, water practices have broader perceptions derived from the meanings attached. Linking the meanings of water and practices, Linton states that, "all by itself, water is supremely fluid, fluctuating, fleeting. We mix language, gods, bodies, and thought with water to produce the worlds and selves we inhabit" (Linton, 2010:3). In the foregoing quote Linton is alluding to the fluid interpretations and meanings of water which are (re)constructed over time through the everyday practices. Likewise, the meanings and interpretations of water by various actors influences their "willingness to pay" and the "willingness to conserve" water. Equally, the decisions that actors make about water are based on these understandings and perspectives. Linton further contends that "the way water is conceptualized and represented is instrumental in determining who gains access to it and on what terms" (ibid.:69).

7.3.3 Gender Dynamics

Gender dynamics also differentiated the experience that residents have with water services in Kya Sands. Interview responses from residents and key informants showed the involvement of women in the decision-making process on the provision of water services especially through the settlement committee (see Section 6.2). In an interview response, a female resident who is generally regarded as the pioneer of the settlement and is part of the settlement committee explained, "I know how dire the water situation has been here in Kya Sands in the past. (...) residents report water problems and I call JW to fix them. I ensure residents obey the rules and if they do not, they are put in police custody" (Personal communication, community leader 2, 2-12-18).

From the interviews, I learnt that within households, women were responsible for procuring and ferrying water to the house as well as distributing water for various tasks and chores. A female resident elaborated that "... I distribute the water as I do most of the house chores" (Personal communication, Kya sands resident 12, 16-11-18). Another female resident was amused when I posed the question about who collects water in the household and then responded, "obviously as the woman I am in charge" (Personal communication, Kya Sands resident 18, 22-11-18). Whereas women assumed the duty of procuring water, the execution of the repairs of the physical infrastructure was the responsibility of men. Findings from a comparative study in Accra, Ghana, and Cape Town, South Africa (Harries et al. (2016) revealed that procurement of water is a task that is largely performed by women. Similar findings were presented under intersectional analysis in the Mukuru case study (see Section 5.7.2 for related discussions). Overall, the findings suggest that the notion of people-as-infrastructure with regard to access to water services in informal settlements is in reality women-as-infrastructure.

7.4 PRACTICES OF RESIDENTS

This section discusses practices for gaining and maintaining access to water services by the residents of Kya Sands based on the summary presented in Table 7.1. The practices are broadly categorized as coping mechanisms, water gifts, repairs and practices around the tap. As previously discussed in Section 6.4.1, the main provider of water for the residents is JW through standpipes located throughout the settlement.

Coping mechanisms

The residents disclosed that coping mechanisms are influenced by their past experiences in accessing water services, proximity to the standpipe and personal safety concerns in procuring water. Coping

mechanisms demonstrate individual and collective agency of the residents in dealing with inadequate services. Interview responses from residents and the FGD revealed that given the reliability of water services to the settlement, the majority of the residents did not store water. During the transect walks, I observed that there were no large water storage tanks in Kya Sands in contrast to their prevalence in Mukuru though they fetched more water than they would need in a given instance which they stored in jerricans. The residents who accompanied me elaborated that, "water never goes for long and it comes back quickly" (Personal communication, community leader 2, 22-11-18).

Nevertheless, a few of the residents interviewed indicated that they stored water in their houses to hedge against the risk of water supply interruptions however brief and to avoid going to the standpipe at night. International literature such as Burt and Ray (2014) study in Hubli-Dharwad, India, shows that despite the provision of continuous water supply, residents continued to store water in their houses largely due to a history of mistrust between the residents and the water company that developed when the water supply was intermittent which affirms the findings in Kya Sands. Equally, interview responses from the residents in Kya Sands indicated that rainwater harvesting was not a salient source of water. A resident explained that, "the roofs are dirty, and the water has limited uses but also there is clean water at the standpipes" (ibid.). Contrary to Peloso (2014) findings in Ashaiman, Accra, Ghana, which indicate that total dependence on formal sources of water would expose the residents to higher risk in times of water shortage, the residents of Kya Sands largely relied on the water supplied by the state through the standpipes

Water gifts

Water gifts were a common source of water in instances when it takes longer to return after an interruption. Residents who live in Sections A, D and E close to Agnes Road crossed over to Bloubosrand, a middle-income neighborhood, to borrow water (see Figure 6.1). During an interview, a resident participant intimated that, "we go there to try our luck though they never say no to us" (Personal communication, resident 13, 27-11-18). The same resident pointed out the symbiotic relationship that exists between the residents of Bloubosrand and Kya Sands stating that, "you see, when they have no water, they get it from the standpipes here" (ibid.).

Besides, a study of water gifts in Khartoum, South Sudan (Zug and Graefe, 2014) argue that water gifts are an indication of a fluid solidarity among residents within and across the settlements thus reconfiguring the urban waterscape by making water accessible to people who cannot afford it. Likewise, residents who live in Section B and C are more likely to go to the neighboring factories to ask for water. Interview

responses from residents indicated that the factories were an assured source of water because the majority of employees in the factory live in Kya Sands, hence they sympathized with them. Water gifts are prevalent where households of different socioeconomic status live in close proximity or where some people are connected to a water network while others are excluded (ibid.) (see Figure 5.8). The spatial heterogeneity between Kya Sands and Bloubosrand facilitates exchange of water between these residents. Equally, the proximity of households with similar economic status situated on the margins of a network facilitated relations of reciprocity and trust within networks. During the FGD, a resident revealed that when he cannot go to the standpipes at night, he borrows water from his nearby relatives while another resident indicated that, "when I need water urgently… I ask my neighbor for some … they also do the same …." (FGD, 23-11-18).

Repairs

In order to reduce vandalism on physical/material infrastructure in the settlement, JW uses plastic taps which are less durable (see data and analysis presented in Section 6.4.2). Interview responses revealed that residents report breakdowns or leaks to JW through the ward councilor or the settlement committee but JW often takes long to respond. They therefore implement rudimentary/improvised repairs to reduce the leaks (see Figure 7.2). Besides, members of the settlement committee mobilize residents living near such standpipes to purchase a tap and fix it (Personal communication, community leader 6, 29-11-18). This assertion was corroborated by a resident who explained that, "we contribute 5 Rands for the committee to buy a tap and repair" (Personal communication, resident 19, 23-11-18). Another resident explained that, "the system works well, and the repairs happen fairly quickly" (Personal communication, FGD, 28-11-18). However, some residents disagree with this approach claiming that, "the committee collects the money for their personal use". (FGD, 28-11-18). A resident complained that, "there are people who do not cooperate, but you cannot force them to pay or tell them not to fetch water" (Personal communication, resident 15, 18-11-18). This finding denotes the significance of social and power relations in gaining and maintaining access to water services which is key to my research question and overall findings.



Figure 7.2: Improvised repairs of a leaking tap by residents in Section E

Further interview responses indicated that, "sometimes JW leaves spare taps with residents living close to a standpipe to facilitate repairs" (Personal communication, community leader 2, 02-12-18). This practice illustrates the political creativity of JW officials who challenge the rules issued by the utility that constrain actions and responses on the ground. Likewise, it demonstrates that infrastructure repairs are less dependent on the utility's calculations or approximations and more on the negotiations with the residents who are more conveniently located and also more knowledgeable about the local physical infrastructure. However, during the transect walks, I noticed an illegal connection from the standpipes, and upon probing, a resident explained that, "the plumber who repairs broken taps recompensed himself by putting an in-house connection" (Transect Walk, 12-12-18). A member of the settlement committee who was present corroborated that the residents agreed on this form of compensation for services rendered. Although JW is aware of such illegal connections, it prefers to ignore them due to political sensitivities (see Section 7.2.2). The residents and JW are each ignorant and knowledgeable about different aspects of the infrastructure which creates a mutual interdependence in executing repairs.

Practices around the tap

Interview responses from residents and key informants indicated that behaviour of residents around the tap is guided and regulated by a set of informal rules and regulations. These rules and prescripts regulate the interactions between residents in Kya Sands as well as other players in water services. This finding is related to Bourdieu's discussions on the notion of doxa as presented in Chapter 2. A resident revealed that there is resistance to the rules among the residents, and offered an example, "recently I told my neighbour not to do laundry at the tap and she answered saying, "'this is not your tap! Who are you to tell

me what to do?' and stopped talking to me since then" (Personal communication, Resident 2, 27-11-18). This comment points to the fact that social relations between residents are simultaneously made or broken during the process of water access. During the transect walk, a community leader explained that the rules were devised by the settlement committee because "if you leave people on their own, the place will be out of control" (Personal communication, community leader 2, 22-11-18).



Figure 7.3: A resident washing clothes at the standpipe in Section A

Interview responses from the residents indicated that not all residents were aware of the rules that govern the practices around the tap. In an interview, a resident revealed that, "I do not know the rules, I do whatever I want" (Personal communication, resident 15, 29-11-18). This means that the rules were largely flouted, intentionally or unintentionally, by the residents. During a transect walk, I observed residents engaging in prohibited behaviour such as doing laundry at the tap or placing clothes on the taps and continuing with the prohibited activities until the community leader explained to them that they were breaking the rules (see Figure 7.3). Likewise, in the transect walks, I observed the indiscriminate disposal of wastewater which served as an indication that residents did not adhere to the rules about wastewater disposal.

In the transect walks, I observed some residents placing their laundry basins under an open tap "for the water pressure to wash their clothes" (ibid.). Besides, some residents were drinking directly from the mouth of the tap. My guide explained that although both these practices were prohibited in Kya Sands, there were no sanctions for the transgressions. A community leader elaborated that, "the residents

change the rules to suit their needs if they find them cumbersome" (Personal communication, community leader 6, 29-11-18). However, during the FGD, some residents explained that they were not sure who was responsible for enforcing the rules in the settlement. From the foregoing discussions it is clear that people in informal settlements are not necessarily lawless but are instead agents actively engaged in the (re)making of rules through everyday local practices. Table 7. 2 presents a summary of the rules and their rationale based on responses from interview with residents and key informants.

Table 7.2: Summary of the rules of access to water services in Kya Sands

Rule	Sample responses
1. Queueing: First come, first served basis	"Whoever arrives to the tap first fetches water first out of fairness and respect for the other residents".
2.Close the tap properly after use.	"We close the taps tightly to avoid wastage of water and runoffs getting into people's houses". "If they do not change then some taps on the pipe are closed to make them suffer as a punishment for their sin and if they don't change them all taps are closed and so they have to walk to other water points that are further to collect water".
3.Washing clothes or dishes should not be done at the standpipe.	"We should not put bucket at the tap while one is washing as it obstructs the queue". "Inhibiting others from accessing water and people tend to be rude when they are told".
4.Clothes should not be placed on the standpipe.	"We fetch drinking water from the same taps"
5.Residents should not bath or brush teeth at the standpipe.	"bathing at the tap is prohibited out of basic decency and we cannot expose our children to such indecency". "people should not drink directly from the tap because it is not hygienic" "some people are unhygienic and they take baths at the taps".
6.Water disposal should be done in the open trenches.	"dispose wastewater in the trench to avoid slipperiness which could cause other residents to fall".
7.Solid waste should not be disposed of in the open trench.	"Solid waste obstructs the flow of the wastewater and generates a foul smell. The wastewater then starts to flow into our houses".

7.5 INITIAL REFLECTIONS ON ACTORS AND THEIR PRACTICES IN KYA SANDS

The Kya Sands case demonstrates that water governance in informal settlements is characterized by multiple actors with overlapping remits and is highly fragmented without a single source of authority. The water governance is characterized by formal and informal exchanges/networks embodied as a system that enables service provision and engagements between the officials and citizens. The residents interact with the state in transversal ways in the process of accessing services by circumventing the official frameworks. These formal and informal engagements thus produce diverse practices, contestations and non-normative modes of water governance which is critical for the research question of this study. The chapter demonstrates the significant extent to which the residents are the main agents in the production of space and water services provision as opposed to passive recipients of spaces created by others. More than directly confronting (or violating) the official governing logics the residents of Kya Sands operate in transversal ways using negotiations and contestations. This finding demonstrates how informality permeates the urban waterscape whereby the elite and the low-income areas are neither socially or spatially autonomous from each other nor disconnected from the rest of the city.

Further, the chapter deepens our understanding of agency in relation to structure through and from the practices of the state officials which foregrounds the idea of power relations. For example, JW officials may take sub-optimal decisions given various political sensitivities which lead the officials to ignore certain aspects like illegal connections. The evidence of state officials balancing across diverse views and interests of various actors in executing their duties opposes the duality between agency and structure and thus affirms the idea that state officials exercise creativity in the course of exercising their duties. Therefore, how different actors view their agency to change the status quo influences the extent and intensity of their contestations during the process of accessing water. In line with discussions by Bayat, (2010) in Section 2.5 uncontrolled zones arise when the state lacks the capacity to fully control processes or activities which produce spaces of relative freedom that are appropriated by non-state actors.

Given that there are 180 recognized informal settlements in Johannesburg JW officials lack full information of the realities on the ground. However, how much in-depth knowledge of the infrastructure can the state officials have about the reality of these informal settlements which are characterized by fluidity and complexity? This indicates the need to seek better understanding on why they are not able to carry out the repairs by going beyond the stereotypical description of state officials who are often portrayed as lazy, inefficient and corrupt. The state which is supposedly the expert and the supplier of water services is dependent on the residents for their knowledge of the infrastructure and coproduces

the required repairs with the residents and shows the agency of the residents in gaining and maintaining water access. This blurriness of formality and informality begs the question of what then constitutes their formality.

The role of people as infrastructure from the perspective of the human body and social relations is salient in this chapter. Importantly, the chapter gives a nuanced understanding of Simone (2004) notion of people-as-infrastructure as women-as-infrastructure with regard to access to water services in Kya Sands. Women however relied on men to execute the repairs of the physical infrastructure since they had knowledge of the water reticulation in the settlement. The chapter shows how fragile and unstable and constantly (re)negotiated social networks are forged in the process of gaining or maintaining access to water services. Residents rely on social relations to uphold the norms and rules which structure the behaviour and govern access to water in the settlement, to stay informed about water interruptions as well as for water gifting.

CHAPTER EIGHT

8 CROSS-CASE ANALYSIS OF WATER GOVERNANCE IN MUKURU AND KYA SANDS INFORMAL SETTLEMENTS

8.1 INTRODUCTION

The previous four chapters presented data and analyses on the three sub-questions for both case studies. This chapter embarks on a cross-case analyses and discussions of the findings in light of the literature appraised as well as the conceptual framework that guided the study. In other words, by undertaking a second layer of analyses, this chapter speaks into the literature by elevating the descriptions from the case studies to the theory towards the theoretical contribution of my study. Consolidating the issues from both case studies provides a clear picture of the commonalities and differences of water governance in the study contexts. Given the diversity of informal settlements, the two cases are not representative of informal settlements in both cities. However, although the cases are contextually and historically different it is possible to use the differences to analyse the varied outcomes in access and the realities of residents living in informal settlements with regard to access to water services and offering transferable insights.

The chapter will show the complexity of governance and how that impacts on the provision of basic services in urban informal settlements. Practices reveal how water governance as an outcome of the interactions of different actors is manifested and executed. Further, practices enable the close relationship between infrastructure and the understanding of the different kinds of hydraulic infrastructure to be examined. The chapter also demonstrates how residents structure hydraulic infrastructures as well as how such infrastructures in turn structure the behaviour of residents. In other words, it answers the question: how are hydraulic infrastructures structured and how are they structured by the actors? The chapter foregrounds the importance of people-as-infrastructure in access to water services. Finally, what do the two cases bring out about the state? The chapter based on both cases reveals that gaps in the provision of water services provision are not only the consequence of state absence but also state abstinence.

Juxtaposing the findings of both cases brings out the unique features of governance of water services which deepens our understanding of how infrastructure influences access to water services in informal settlements. Equally, there are transferable lessons that each case can learn from the other. Besides, the presence of cross-cutting issues foregrounds how normative governance of water services is transformed into non-

normative modes of governance by the prevailing conditions and challenges of water access. The chapter begins by drawing the overarching insights and findings through a comparative analysis of conditions and challenges in both contexts. It then moves on to interrogate and compare the findings in both settlements based on the themes from the conceptual framework which include infrastructure, social practices (people-as -infrastructure), the role of the state and governance and coproduction.

8.2 CONDITIONS AND CHALLENGES OF WATER SERVICES IN MUKURU AND KYA SANDS

Findings from the case studies reveal the mediating role of both human and non-human infrastructures in gaining and maintaining access to water services. In line with McFarlane's (2009, 2011) notion of the assemblage, infrastructure in informal settlements comprised of pipes, pumps, tanks people and plastic jerricans that together create visible, fluid and dynamic systems of water services. Further, discussions in Chapters 4 and 6 show the heterogeneous distribution of infrastructure in both settlements is influenced by land tenure and power relations as well as how the infrastructure in turn shapes the experiences and practices of residents in accessing water services. Moreover, the uncertainty of land tenure has generated temporary and transitional infrastructure in both settlements which indicates how land tenure as well as the development and evolution of the settlements influence the installation of material infrastructure.

The Ngong and Jukskei rivers that cross Mukuru and Kya Sands settlements respectively were the initial sources of water but subsequent pollution from industrial and domestic waste rendered the water unusable. This necessitated residents to pursue alternative modes of access and the study has mapped the status quo outcomes of the evolving pursuits in both settlements. Water scarcity and unreliability in Mukuru has generated a meshwork of formal and informal alternative sources of water to meet the daily water requirements of the residents. Unreliable water provision increases the number of intermediaries in the supply chain which raises the probability of water contamination. In Kya Sands, the provision of water services is relatively reliable thus calling for fewer alternative sources of water (water sources are less diversified compared to Mukuru). Table 8.1 presents a summary of the comparison of the conditions and challenges of access, uses and disposal of water services observed and reported in both contexts.

Table 8.1: Cross-case analyses of water access, use and disposal

PARAMETER	THEME	MUKURU	KYA SANDS	COMPARATIVE HIGHLIGHTS BY CATEGORY AND ELEMENT
Water access	Sources of water	-Water vendors. -Borehole and wells. -Rainwater harvesting. -Water gifting.	-Standpipes. -Water gifting.	-Sources of water depend on the reliability of water services. -The role of temporality in water access. -Power relations: Diverse ownership of material infrastructure (state or non-state actors). -Social relations are crucial for water access. -Increased intermediaries in water supply compromise the quality of water and increase the cost
	Infrastructure	Material, social relations, knowledge and laws and regulations.	-Material, social relations, knowledge and laws and regulations.	
	Characteristics of water	-Low quality. -Intermittent supply of water. -High cost in terms of money, energy and time of procuring.	-High quality. -Greater frequency in supply. -Low cost in terms of time and money. - Less intermittency and greater predictability.	
Water uses	Types of uses	-Domestic -Cultural and religious practices. -Commercial.	-Domestic -Cultural and religious practices -Commercial -Urban agriculture	-Commonality in domestic uses of water. -The morphology of the settlements influences the practice of urban agriculture. -Role of women in distribution of water in the household. Intrahousehold conflicts related to water use.
Water disposal	Methods of disposal	-Open trenches -River -Accumulation	-Open trenches -River -Accumulation -Sprinkling	-The morphology of the settlements influences how water is disposed. -Topography: Wastewater runs downhill into the river. -Interhousehold conflicts induced by waste water disposal.

Wastewater disposal is problematic in both settlements and is often a source of both intrahousehold and interhousehold conflicts. The domestic uses of water are common in both settlements, except for use in private and communal urban agriculture in Kya Sands but not observed in Mukuru. This finding could be explained by the random and haphazard organic development of Mukuru which leaves hardly any residual/secure space for practicing urban agriculture. On the other hand, the relative reliability and affordability of water services provision in Kya Sands incentivises the practice of urban agriculture by some of the residents. This finding indicates the agentic influence of material infrastructure in connecting the state to the everyday lives of citizens such as domestic chores, drinking, bathing and urban agriculture as discussed in Section 2.3.1.

The role of temporality in access, use and disposal of water services is salient in both cases. Similar to Anand's (2017) study of Mumbai, India that infrastructures mediate time by enabling or disenabling certain aspects of social time such as when the residents carry out activities as well as how they interact with the infrastructure at different times. Importantly, twilight is a key point of reference in both settlements since while it brings suspension of certain activities for instance collection of water from the standpipes for security reasons, other activities commence in both settlements such as the indiscriminate disposal of wastewater and solid waste. Chapter 4 shows that, the water points in Mukuru are closed in the twilight while illegal connections from the main pipes are made at night. Moreover, oftentimes water is not available during the day in Mukuru and residents go in search of water at night when it usually comes back. Findings in Chapter 6 show that residents in Kya Sands engage in indiscriminate wastewater and solid waste disposal practices in the twilight when their activities are obscured from the residents or members of the settlement committee. The indiscriminate disposal of wastewater was often the cause of inter-household conflicts in the settlement. These findings indicate that politics are fragile accumulations of socio-material processes that are continuously (re)created through continuous interactions of human bodies, discourses and other things such as potable water and wastewater (ibid.).

Both case studies shed light on the relationship between infrastructure and political rationalities. The Kya Sands case study showed that the majority of the standpipes were installed in 2008 ahead of the 2009 general elections. However, the Mukuru case study showed minimal involvement of local politicians in the supplemented state service provision and as a result, the politicians do not rely on mediating for the provision of water services to create a vote bank. These findings suggest that access to water services as mediated

by infrastructure is influenced by different past, present and future political rationalities that differ between contexts. Hence material and symbolic significance of infrastructure allow the emergence of non-normative modes of governance to flow from the varying coalescence of political and social relations. This is in congruence with discussions in Section 2.5 on the agency of material infrastructures as the product of "various historical forms and technopolitical relations" and power which results from "alliances of objects and practices" (Meehan, 2014:217). Thus, infrastructure is a source of power for both residents and the state as they 'look' at it with expectations of diverse and differentiated sets of benefits/opportunities.

8.3 INFRASTRUCTURE

8.3.1 Material Infrastructure

This section looks at the visibility as well as the selective porosity of infrastructure. In line with Larkin (2013:328) The study demonstrates that infrastructure is an "architecture of circulation" that allows the flow and distribution of resources in the city. In Kya Sands, the reticulation of the material infrastructure is largely invisible while in Mukuru the pipes and chambers are visible. The exposure to the elements makes the visible infrastructure prone to breakage necessitating frequent repairs. The visibility of the infrastructure in Mukuru could be explained by the neoliberal approach to the provision of water services through a highly commercialised and competitive environment which creates low levels of trust between the water vendors, and in line with neoliberalism discussions in Chapter 2. The high levels of mistrust lead the water vendors to prefer visible pipes so as to monitor tampering on and around the pipes.

However, though infrastructure in Mukuru is visible and exposed, the social relations around water services tend to be invisible contrary to the argument that "burying the flow of water (…) facilitates and contributes to masking the social relations through which the metabolic circulation of water takes place" (Kaika and Swyngedouw, 2000:121). Therefore, examining the visibility of material infrastructures indicates how people engage with it and how it renders social relations less visible. Arising from this finding, I argue that the visible and heterogenous material infrastructure in Mukuru generate multiple interactions which increase the density of social relations between actors. Urban density in this study is extended beyond people and the ratio of population to area to include how the urban is "differently produced, experienced, perceived, negotiated and contested as people live in and move through the city" (McFarlane, 2016: 632). Given that densities are an expression of inequality, the experiences of density are mediated by class, gender and ethnicity among other social factors which generate diverse interactions between actors as they negotiate for water access.

Additionally, the idea of selective porosity by Kaika (2015) as discussed in Section 4.5 whereby infrastructure circulating clean water is visible while that which circulates unclean water is invisible (though separations are disrupted during crises) does not apply to both settlements. Unlike in the formal prescints where material infrastructures remain largely invisible, infrastructure in informal settlements is visible given the organic development of the settlements (see Section 4.2.3). In Mukuru both the clean water and wastewater infrastructures are visible while in Kya Sands only the wastewater infrastructure (the jerry rigged trenches) is visible (see Appendix 6). However, there are moments in Mukuru when the clean hydraulic infrastructure is invisible for instance during inspections by NWSC officials when pumps become 'invisible' (either because they are hidden by the water vendors or the officials choose not to 'see' them).

Furthermore, the fact that infrastructure creates opportunities for ingenuity and creativity for diversion of water by the residents and transforms power relations makes infrastructure a source and force of power. Equally, von Schnitzler (2013: 688) study of prepaid water meters in Phiri, Soweto, Johannesburg found that residents and users engage in "endless cycle of innovation and subversion" as they appropriate diverse types of infrastructure. On the other hand, hydraulic infrastructure is also a manifestation of modernity which forces political discipline and circulates a valuable resource in the urban precincts. The variegated relations between the state, economy and informal settlements are vital to the diverse material configurations that become possible and durable within informal settlements.

Overall, the findings from Chapters 4 and 6 are contrary to Heidegger (1962) argument that infrastructure becomes visible when conspicuousness, obtrusiveness or obstinacy occur (see Section 2.2). This study shows that Heidegger's distinction of visibility and invisibility is too rigid to adequately capture the reality of informal settlements in the global South where the visibility of both the clean and wastewater infrastructures is a salient characteristic of water services delivery. Hence, the line between the visibility and invisibility of the infrastructure is porous which entails 'the lack of clear boundaries between phenomena, a permeation of one thing by another, (...) sacred and profane' (Gilloch,1996: 25). Importantly, the relations between the different elements such as the pipes, meters and taps are constantly reconstituted by people during the process of access to water services. These relations foreground the agentic properties of material infrastructure through infrastructural inversion whereby infrastructure acts upon and is acted on by things (Bowker et al. 2010). Moreover, the social relations that emerge from infrastructure which are fluid, alive and dynamic and experienced in different ways in the same as well as across spaces. This section shows the

blurred line between visibility and invisibility of hydraulic infrastructure in informal settlements contrary to Heidegger (1962) arguments as reviewed in Section 2.2.1 where visibility of infrastructure is deemed to arise from a disruption or crisis. Both case studies show how material infrastructures produce the territories where water flows while the interactions between people and infrastructural knowledge make the flow of water possible.

8.3.2 People as Infrastructure

This section looks at the comparison of how people, specifically through social relations and the human body, form a constituent part of the hydraulic infrastructure as well as how the circulation and distribution of water structures the relationship between people and water. While material infrastructures produce the territories where water flows, it is people and the knowledge of infrastructure that make the flow of water possible. The Mukuru and Kya Sands case studies reveal that when people do not have piped water in their houses the human body becomes a constitutive of the hydraulic infrastructure for last mile delivery of water services. Even when water services are free and financial resources are not required to access them, the human body is the crucial physical medium of bringing water home. This finding demonstrates the critical role of people-as-infrastructure through which water services are circulated particularly in informal settlements of the global South which is key element of this study.

Furthermore, by taking a gendered perspective on data and analyses of people-as-infrastructure, findings from both cases revealed that the female body is a visible component of the hydraulic infrastructure. Intersectionalities of Simone's (2004) idea of *people-as-infrastructure* with regard to access to water services in informal settlements, suggests that in reality it is largely *women-as-infrastructure*. Moreover, further intersectional analysis of women-as-infrastructure reveal that given the past politics of apartheid and the infrastructure inequalities it produced (especially in in South African cities), the *black-female-body-as-infrastructure* is a prevalent element of the hydraulic infrastructure in Kya Sands. This significant finding extends the visibility of the material infrastructure to people-as- infrastructure to instances such as when women are waiting in line at the water points or the standpipes and as they carry buckets or jerricans of water. Thus, people-as-infrastructure element adds visibility to the hydraulic infrastructure.

The practice of *'bringing work to the tap'* in Kya Sands creates social networks which are useful for accessing water services in future or for upholding the rules governing water services in the settlement (see Section

6.4.2). This indicates that infrastructure may permit different practices by actors at the same time. On the other hand, in Mukuru social networks are forged as the residents walk within and outside the settlement in search of water or on the queues as they wait for their turn to procure water. Besides, water rationing schedules create temporality in water availability that necessitates negotiations between actors for access to water services. Furthermore, social relations are critical for women in Mukuru given that they walk in groups (for security reasons) in search of water at night. I argue that through social relations, infrastructures extend beyond the original site where they are constructed and are constantly reconfigured-usually on a daily basis. Social relations of the different actors produce inequalities in access to water services and the corresponding effects of exclusion of some actors based on power relations.

Likewise, social relations play a critical role in the complex phenomenon of water gifting with or without reciprocity whereby the giver expects a return of the gift or some other benefit in future. The study finds mutual exchange of water among residents in both settlements. In Kya Sands, water gifting entails a symbiotic relationship whereby residents from the informal settlement and the neighbouring middle-class settlement of Bloubosrand exchange water during water supply interruptions in either of the prescints (see Figure 6.1). The exchange between the two settlements creates a reciprocity and solidarity that traverses socioeconomic boundaries. Conversely, the reciprocity of the 'water gift' in Mukuru is demonstrated by the common but tacit understanding that the receiver will provide water to the giver in the future. The 'water gift' affects the socio-political relations among residents by bridging the inequality gap while simultaneously revealing and concealing the urban waterscape fragmentation (Zug, 2014). Water gifts create social relations that transcend socioeconomic boundaries while also consolidating the existing ones. Whereas water gifts do not involve monetary exchange, the activity requires the human body to collect the water and poses risks to residents who cross busy roads carrying water through connecting various settlements.

Since water gifts do not involve financial transactions the social context (such as socioeconomic status and altruistic motives) in which the exchange takes place is important. In Kya Sands, residents accessed water gifts that were above the minimum requirements for survival while water gifts between residents in Mukuru aimed at meeting the minimum daily requirements. This difference could be explained by the heterogenous spatial configuration and socioeconomic variations between the residents of Kya Sands and Bloubosrand given that the economic field (which produces symbolic capital) influences the physical field that people can afford to occupy (Bourdieu, 1994). Thus, gaining and maintaining access to water services by residents of

both precincts is based on neighbourhood relations. Besides, the high-income levels imply that the residents of Bloubosrand can afford to pay beyond their own consumption of water. Conversely, Mukuru residents are unwilling to share water with neighbours given their meagre income and the effort involved in procuring it. Additionally, the meaning assigned to water affects the practice of water gifting. Social and religious significations of water influence the social-power relations that emanate from the water gifting exchange (Zug and Graefe, 2014). Hence, water gifting based on unselfish and humane reasons produces moral capital in which people give goods and services for altruistic motives (Bourdieu, 1994).

In conclusion, whereas the control of water services depends on ownership and power over infrastructure gaining and maintaining access to water services is predominately influenced by social relations. The significance of people-as-infrastructure in both settlements generates fluidity in normative water governance since the interactions between actors are continuously (re)created and (re)negotiated to generate non-normative modes of governance.

8.3.3 Knowledge as Infrastructure

This section discusses findings on knowledge of the infrastructure as well as how the legal and institutional frameworks influence the gaining and maintaining of access to water services. Findings from Chapters 5 and 7 show that in both settlements, state officials depend on the infrastructural knowledge of the residents to locate the relevant infrastructure to implement repairs. In Mukuru water vendors have a profound and deep understanding of the workings of the material infrastructure and the municipal authorities depend on their expertise to solve problems. Similarly, based on a study of water access in Mumbai, India Bjorkman (2015) argues that networks of knowledge exchange are crucial for gaining and maintaining water access. Both case studies revealed that infrastructural knowledge possessed by the residents is both explicit and tacit given their prolonged engagement with the hydraulic infrastructure. Expounding on the idea of tacit knowledge, Bohm and Peat (2000: 6-7) state that “most valuable skills exist in the form of such tacit infrastructure of knowledge. (…). It takes subliminal and mainly unconscious form since no one actually ‘thinks’ (…)… a great deal of such knowledge and skills which are at his or her finger tips”.

In the Mukuru case, efforts to access the reticulation maps from the NWSC officials proved futile as they did not know the location of pipe connections and had to depend on the residents for the information (see Section 5.6). Equally, the peculiarities of both informal settlements (in terms of fluidity and diversity of composition)

led the utility companies to look for alternative ways to gather relevant information from the residents in order to maintain access to water services. According to Benit-Gbaffou (2018:5) ignoring or drawing little attention to informal settlements creates gaps in the knowledge of the infrastructure by the state making any useful improvement difficult since knowledge is the point of departure for implementation of changes. Further, infrastructural knowledge and control are decentralised and personalised due to the involvement of diverse actors (Bjorkman, 2015). Thus, water governance is based on the collaboration of multiple actors as opposed to single agency whereby one or a few actors control the process while other actors remain as passive recipients of whatever they can get.

Importantly, the findings from both case studies demonstrate the complexities of how knowledge-as-infrastructure and people-as-infrastructure overlap through social relations. Besides the technical dimension, repairs have sociological dimension since the state officials need to tap into the knowledge of the infrastructure that the residents possess. Ostrom (1996) argues that knowledge is required to understand the nature of the service as well as how it should be produced through the involvement of the actors in the process. Hence the repair of infrastructure is a socio-technical process (laden with power inequalities) which produces knowledge necessary for executing repairs through state and non-state actors. Moreover, maintenance of water services provision is not just about repairing the physical infrastructure but also about mending social relations. For instance, during the process of water access social relations are simultaneously built and fractured leading to continuous (re)configuration of the social relations.As previously stated in Section 8.3.2, although in both study areas women retrieved the water, the role of maintaining and repairing pipes and taps was assigned to men. This finding suggests a division of gender roles which creates increased opportunities for engagements, negotiations and contestations between the genders both at the intrahousehold and interhousehold levels.

In summary, the case studies demonstrate knowledge generated about water as a product of complex permutations of power relations and the interests of actors which indicates that water governance frequently involves making contested decisions under conditions of varying interests. The reliance of the state on the residents and water vendors in the Mukuru case, for knowledge of the infrastructure produces an inversion in how we understand governance and the relationship between the state and its citizenry. Hence water governance is not so much about supply and demand or expertise of state and non-state actors but a political process in which actors have different degrees of agency to influence the pursuit and realization of desired

outcomes. Overall, this study contests the attribution of agency mainly to human actors (and hence assuming passiveness of non-human elements) as an aspect of normative mode of water governance and demonstrates that agency is more broadly distributed even to non-material infrastructure, including knowledge.

8.4 THE ROLE OF STATE AND GOVERNANCE

The state is a significant player in provision of water services in both contexts. In Kya Sands, water services are predominantly provided by the state while in Mukuru, the cartels in collusion with state officials dominate the provision of water services. The hydraulic infrastructure in both contexts becomes the medium through which the residents experience the state and are seen by the state. However, the governance process involves other actors with varying interests and power which generate contestations and negotiations in water provisioning because power relations are constantly "recreated in interactions and thus constitute a dynamic process of wielding and yielding" (Haan and Zoomers, 2005:37). The case studies demonstrate how the dynamic capillary thinking of infrastructural power infiltrates the contestations and negotiations of the power of various actors which generates inequalities in access to water services in congruence with discussions presented in Section 2.5 by Mann (2008) and Wafer (2011). Similarly, thinking through infrastructure reveals how infrastructural power is reified when material infrastructure enables the permeation of state capillary power through points of interactions of diverse actors creating power centres both inside and outside the confines of the state.

While clearly demonstrating that the state does not exercise monopoly of power, both cases bring out the opacity of the state and how the state employs opacity by hindering certain things while allowing others. In Kya Sands, the delay by JW to execute repairs leads the residents to carry out the repairs through the settlement committee without having recourse to JW. In Mukuru the lack of state involvement in the last mile delivery of water services led to the emergence of cartels who took over the provision of water services. Whereas the cartels in Mukuru were not the only factor that influenced water access, their presence significantly affected the dynamics of the process of gaining and maintaining access to water services. The design and subsequent implementation of the water chambers in Mukuru led to the capture of service provision by the cartels. In line with discussions by Cornwall (2000;2002) on coproduction in Section 2.7 this situation can be understood as a form of invited coproduction since the system depended on the residents' involvement in the last mile provision of water services.

The imbalance between the state's capacity to provide water services to residents throughout Mukuru settlement and the demand for the services overwhelmed the state leading to its shrinkage or abstinence from service provision (Ngunyi and Katumanga, 2014). Consequently, the cartels became the dominant actors in the provision of water services. While initially the relationship between the residents and the cartels was symbiotic, it gradually turned parasitic as the cartels became entrenched in the provision of water services. The cartels brought water services closer to the homes of the residents but now the residents depend exclusively on cartels for water services making them vulnerable to exploitation. Besides, state abstinence was also occasioned by the state officials partaking in the illegal activities of the cartels thus making it difficult for the state to act impartially as would be expected under normative mode of governance. Thus, while the state is present in Mukuru, it also remains remote through deliberately ignoring the malpractice of the cartels (ibid.). Given that the state is further away from the residents, the cartels gain legitimacy by becoming alternative service providers in the feigned absence of the state. Hence, water services provision gaps in Mukuru are not only caused by state absence but also by state abstinence. Likewise, in Kya Sands the state ignores and avoids dealing with the illegal connections due to political sensitivities among the different actors. Both cases demonstrate that, while state action and inaction influence access to water services, they most importantly demonstrate the extent to which normative mode of governance (which supposedly guides the practices of state officials) become transformed to non-normative mode due to conditions and challenges at the point of access.

Assemblages influence how multiple interactions between diverse urban residents create different ways in which urban life is experienced (Simone, 2008). Generally, assemblages are formed and created through unequal power relations whereby certain actors have greater influence than others to "create, and defend their own urban environments" (McFarlane, 2010:656). Since the informal sovereigns function like the state through collusion with state officials, they often operate in zones of exception straddling between public and private spheres Hansen and Stepputat (2006).). In line with Chatterjee's (2004) discussions on political/civil society dichotomy (see Section 2.5) informal sovereigns employ both abusive and predatory tactics as well as supposedly philanthropic practices to access services. Hence, the informal sovereigns mediate access to basic services especially for the poor by straddling between state-society boundaries and relying on exploitative practices for personal economic gains. Given that informal sovereigns mimic state operations they could be categorized as twilight institutions as defined by Lund (2006) as reviewed in Section 2.5.

Watson's (2009) argument of conflicting rationalities generated by different logics of actors was evidenced in both case studies. In Mukuru, some of the lower level officials do not disconnect water supply as and when required since they are empathetic towards the residents since some officials live in the settlement. Similarly, top-level management at NWSC pushes the lower level management to follow up outstanding debts, yet top-level managers have the highest outstanding payments on their accounts. These contradictions indicate conflicting logics between the different actors given the varying interests and the power imbalances whereby state officials utilize loopholes and interpretation of ambiguous rules and policies to adapt the state intentions to the everyday urban realities (ibid.). In line with Razon's (2017) idea of the politics of invisibility as reviewed in Section 2.4, JW officials are aware of the illegal connections in Kya Sands but prefer to ignore them to avoid related political sensitivities around the problem. Hence, the politics of invisibility challenges the implicit assumptions embedded in the normative mode of water governance that does not envisage situations where the state is unwilling, or in several instances, incapable of addressing certain conditions or challenges on the ground.

With regard to the intentionality of the contradictions within the state, evidence from both cases indicates that the contradictions are unintentional given that the state officials exercise discretion on implementing decisions that they deem pragmatic. Benjamin (2004) argues that the state's contradictions are unintended given the relative proximity of lower-level state actors to the local reality who are the ones closest to the reality while the top-level state officials are far from the everyday reality about which they formulate the respective policies. The contradictions make it possible for the informality which enables access to basic services to thrive through porous bureaucracy whereby small incremental changes that are effective but not radical can be "safely" improvised. Through informality and the porosity of the state, spaces of engagement for various actors are generated. Similarly, Roy (2009) contends that informality entails the (re)production of the state where the state employs politics of unmapping when it has no clear land use plan in order to allow itself flexibility for future actions.

In line with the review of Bourdieu and Wacquant (1992) in Section 2.6, the homology of the different fields in which services such as water, housing, land, sanitation and other basic services are integrated is evident in both contexts. Homology is the similarity between structures in different fields which leads actors with comparable status and capital to make like choices while generating social inequalities (ibid.). The lack of security of tenure inhibits the residents of Kya Sands from making formal connections to their houses while

inadequate sanitation and security services influenced access to water services especially at night which led to the indiscriminate disposal of wastewater which includes human waste. In Mukuru, poor sanitation services inhibit the residents from engaging with other sources of water such as rainwater harvesting due to contamination of the water. Homologous fields indicate that as a field water governance is interlaced and intersects with power structures from other related fields (ibid.). This suggests an integrated approach to provision and governance of basic services to informal settlements due to the mutual interdependence of the different basic services.

The state and non-state actors employ creative improvisations such as strategies and tactics that interfere with the formal power structures so as to navigate the field as well as negotiate their positions (Bourdieu,1990). For instance, NWSC officials who rely on the residents for information about alterations on the reticulation system. Similarly, JW officials leave spare taps and pipes with residents who live near the standpipes in case repairs need to be carried out. In both contexts, the state officials in direct contact with the residents exercise discretionary powers which allow them to choose the rules to apply in resolving the problems at hand. This demonstrates how agency is exercised in relation to structure through and from the practices of the state officials. The idea of political creativity which opposes duality of the structure and agency (and embraces the argument that state officials are not totally constrained agents to implement policies or necessarily in opposition with the state) is supported by this practice (Berk and Galvan, 2013). Consequently, state officials are not helpless agents but can "dismantle orders (…) select useful parts (…) and they combine them in new ways (ibid.:8). State officials circumvent structures such as norms, constraints and rules through innovations like suspending, breaking or creating rules. Hence, through political creativity state officials generate non-normative modes of water governance to resolve water-related problems.

In both settlements written and unwritten rules govern the practices and interactions between the various actors though the awareness and the adherence to the doxa varies among the residents. The theory of doxa as articulated by Bourdieu (1984) and reviewed in Section 2.6 shows how diverse actors manipulate rules to work in their favour in the process of accessing water services. Similarly, in a study of service provision in Buenos Aires, Argentina, Auyero (2012:123) argues that in order to obtain services from the state, citizens have to comply with the 'the doxa of welfare' which regulate their behaviour (see Sections 5.4.1 and 5.4.5). In Mukuru, written rules govern the behaviour of cartels with regard to water services while unwritten rules govern the behaviour of the residents. Although the doxa is unwritten in Kya Sands it is verbally transmitted

by the settlement committee (see Table 7.1). Given the fluidity and complexity of informal settlements, the awareness of and adherence to the rules is constrained by the high rate of mobility in and out of the settlement. Furthermore, the disjuncture between their formulation and implementation could be explained by the impracticality of devising detailed rules for every possible situation (Bourdieu, 2006). Exploring the various legal and institutional frameworks in both contexts shows a disjuncture between the normative mode of water governance of water services and the everyday realities of access to water services. This disjuncture generates non-normative modes of social relations between actors with practices that are outside the confines of the state in line with Miraftab's (2004) discussions in Section 2.5.

Equally, the residents in both settlements have to wait in line for their turn to procure water at the water point or the standpipe. The *'first come, first served'* queueing system is practiced as a way of achieving fairness among the residents. Besides, social relations among the residents are forged as they wait in the queue and influence access to water services in the future as well as their compliance to the doxa of welfare. Thus, the mindset of queueing for water services in both settlements is in line with Bourdieu's (1977) notion of habitus, a structuring structure that influences how people behave and interact with each other. As previously discussed, Auyero's (2012) found that more powerful citizens did not wait in line to receive services, thus indicating that waiting in queue was a manifestation of power relations between actors. Similarly, Bourdieu (2000) argues that making people wait is a manifestation of the workings of power and therefore we should:

> "catalogue, and analyze, all the behaviors associated with the exercise of power over other people's time both on the side of the powerful (adjourning, deferring, delaying, raising false hopes, or conversely, rushing, taking by surprise) and on the side of the 'patient' (…) one of the sites par excellence of anxious, powerless waiting" (ibid.:228).

Although habitus is produced by structures and at the same time produces local practices, it is transposable and flexible (Bourdieu, 1990). The flexibility of habitus is shown when residents let another jump the queue when he has an emergency at home. Community meetings in both settlements were critical in creating and reinforcing habitus because as residents attend more meetings, the habitus gets further ingrained in their minds (Bourdieu,1977; Katsaura, 2013). Equally, queueing generated a sense of helplessness in the residents of Mukuru as well as the anxiety of not knowing the outcome of the long wait on the queue in terms of gaining water access. Some residents end up having to wait in a queue everyday uncertain if or when they

will access water services. This results in learned helplessness as defined and reviewed by Seligman (1975) in discussions in Section 2.5 whereby the residents accept and resign to the situation given the limited alternative sources of water. It is interesting to note the contrast between the state of learned helplessness present in Mukuru versus the sense of entitlement in Kya Sands. The findings suggest that the apartheid politics in South Africa created an over-reliance on the state for the provision of services which generated a sense of entitlement among the historically disadvantaged population especially the black population. On the other hand, the fact that there is little hope of obtaining water services from the state in Mukuru leads to frustration and despair among the residents.

The foregoing discussions demonstrate that the normative modes of water governance fail to gain traction on the ground, especially contested by or through the realities of everyday practices which unequivocally demonstrate agency of material and non-material infrastructure. Furthermore, the interactions between various actors are governed by rules which change depending on the situation at hand create complexity and multiple layers of non-normative modes of governance of water services. Additionally, non-compliance to the rules often causes conflict between state and non-state actors as well as interhousehold and intrahousehold contestations.

8.5 COPRODUCTION

Coproduction in both settlements can be based on the idea of invited and invented spaces by Cornwall's (2000; 2002) discussions in Section 2.7. Invited coproduction is when the opportunity to participate in the production of water services is offered by the government or NGO. Invited coproduction spaces entail unequal power that include and exclude certain actors from participating in the process (Cornwall, 2002; Ahlers et al., 2014). Invited coproduction becomes instrumental in gaining, maintaining or improving access to water services particularly in the margins where it is difficult for the residents to opt out of state services. . Invented or self-organized coproduction is created by the residents and is characterised more by a mutual quest for solutions to a common problem and less by power struggles. The residents of Kya Sands and Mukuru are knowledgeable about the reticulation of the water network within their settlements which the states rely on in order to execute repairs.

Invited spaces of coproduction are state led while invented spaces of coproduction are initiated by the community to resolve logistical issues in service delivery or to overcome state incapacity to deliver services

(Cornwall, 2002). Both invited and invented coproduction coexist at different stages of service provision in Mukuru with dynamic relationships of contestation, compromise and transformation which blurs their distinction. In Kya Sands, invented coproduction predominates, especially with regard to repairs, even though invited coproduction exists when JW officials leave spare taps with residents dwelling close to the standpipe. In line with Ostrom (1996), coproduction accommodates the idea that there are several producers of and actors in urban services while relationships between regular producers and consumers form and shape in a synergetic manner.

Furthermore, coproduction involves the collaboration between state and non-state actors and is typically characterized by power imbalances resulting in variegated and contested service provision (Ahlers et al., 2014). This assertion demonstrates the role of people as infrastructure (and particularly social relations) in the process of change and creation of equitable access to basic services (Simone, 2004). Thus, coproduction occurs through sociomaterial interactions of state and non-state actors to deliver services while also resulting in a highly political service provision configuration based on social relations. Swyngedouw (2005:1991) points out that "governance beyond the state" in which service provision is dominated by non-state actors shift towards reducing the role of the state in the provision of services to private actors thus taking a neoliberal approach to water services provision. Hence coproduction can close the gaps between formal urban policies and prescripts issued by the authorities and the informal everyday realities of people in the urban margins. Ahlers et al. (2014) contend that informality pervades the entire urban waterscape. Each form of everyday negotiation (re)produces and contests social relations which negate the notion of a monolithic state given the presence of multiple actors who fade in and out of informality through their identities and practices (ibid.).

As demonstrated in the study, the identities of actors shift as they occupy varying sites for non-normative modes of water governance where different sources of power are exercised, contested and decisions on provision and maintenance of water services are made. Power imbalances inherent in the coproduction process entails collaborations and contestations among actors for control which leads to variegated service provision as well as the exclusion of some actors from the governance process. The coproduction spaces generated yield non-normative modes of governance for gaining and maintaining access to water services.

8.6 GENDER AND ETHNICITY DYNAMICS

A gender perspective facilitated an in-depth understanding of the unequal power relations by examining the social relations and gender dynamics of access, use and disposal of water services. The salience of the role of women in access to water services in both study contexts is congruent with Harris et al.'s (2016) contention that gaining and maintaining access to water is not gender neutral. Findings in Chapters 4,5,6 and 7 demonstrated the diverse knowledge of water between men and women based on the differentiated uses of water, the varied and unequal participation in water governance institutions and the everyday lived experiences and emotions with regard to access to water services. Findings from both study areas revealed that women are tasked with the responsibility of procuring and allocating water to different uses within the household. However, though women are consistently visible in the process of retrieving the water to the house, the repair of material infrastructure was largely the purview of men, which suggests a division of gender roles between the procurement of water and maintaining material infrastructure for ensuring access to water services.

Equally, the working women in both settlements perceived that they spent significant amounts of time procuring water relative to the number of working hours. This finding points to the importance of intersectional analysis that include other dimensions such as age, occupation, migrant and employment status to provide a nuanced understanding of the role of women in water services as defined by Smith (2011) (see Section 2.2.2) . Besides, echoing Anand's (2017) study of Mumbai, India, the intermittent supply of water in both settlements structured the agency of women in accessing water since they have to align their lives according to the water interruption schedules issued by the utilities as well as daylight-hours due to safety and security risks at night. Thus, the gendered temporalities through which the availability of water structured the everyday lives and activities of households produced specific experiences for women (ibid.). Hence, the water interruption schedules structured activities and timetables of women for different household chores. The water schedules produced a gendered subject given that it is women who wait on the queue to procure water amid the anxiety generated by uncertainties over water.

Likewise, practices such as washing clothes and dishes as well as cleaning the house produced social acceptance in the settlement and become a habitus that leads women schedule their activities in ways that are visible to others (Bourdieu,1977). Based on Anand's (2017) study Mumbai, India, daily practices in turn engender a certain typology of resident either labelled as lazy or responsible; clean or dirty. For example in

Kya Sands, some women wash their clothes at the designated laundry areas near the standpipes to enhance their duty-performance visibility to others. In addition, while uniting diverse and varied people (such as those in informal settlements) who suffer a similar predicament, water access in Kya Sands also divides them as each household struggles to access its daily requirements. In line with Anand's (2017) study water access in either settlement depends on how women in both settlements predict and negotiate temporalities provided by the water schedules which in turn impacts their exercise of agency. Consequently, water schedules produced anxiety in women during water access due to the constrained access times as well as the perception that they were responsible for procuring water for their households. These findings suggest that women in Kya Sands structure their agency through the negotiations with various actors to extend the collection hours which create differentiated agency among women.

Although the task of procuring water was borne by women in Mukuru, they were not actively involved in the governance of water services. Similarly, whereas the residents in Kya Sands access water through the standpipes, some residents such as the non-South Africans, are excluded from the community meetings and have no voice in the governance of the water services. These residents prefer to remain invisible and rely on the South African residents as intermediaries to express their views on service delivery and other issues within the settlement. Katsaura (2013) argues that South Africans have a propensity to exclude African immigrants from local community participation while blaming them when things go wrong. In a similar vein, some residents from South African minority ethnic groups felt alienated by the majority ethnic groups. This suggests that the history of xenophobia in urban areas in South Africa may have contributed to the lower density of social relations in the community. Further, Simone's (2004) idea of people-as-infrastructure could be nuanced depending on the migrant status of the residents. In both contexts, governance for water services symbolically included while also materially excluding some actors on the basis of their identities.

8.7 CONCLUSION

In congruence with the working hypothesis, this chapter shows that the modes of governance for water services emerge from the diverse responses of actors in their roles and practices versus the conditions and challenges in gaining and maintaining water access. The commonalities and differences between Mukuru and Kya Sands (in terms of conditions and challenges, actors and their roles/practices structured around the conceptual framework) show how the production of space in urban areas creates heterogeneity and inequalities in access to water services not only within but across cities/settlements as well.

For instance, the agentic character of material infrastructures and the social relations that emerge from infrastructure are dynamic and experienced in different ways in the same and across spaces. Equally, the element of people-as-infrastructure introduces fluidity in the governance of water services since social relations are fragile and constantly (re)negotiated. Further, knowledge-as-infrastructure inverts water governance and our understanding of the relationship between the state and citizens since, though the water utilities have the reticulation maps, they depend on the "on-the-ground" infrastructural knowledge inhered in the residents. Thus, the state is never a sole actor in facilitating and maintaining access to water services. The comparison shows the micro-level processes by which the conditions and challenges of access to water services render the normative mode of water governance malleable at the point of access and through the same processes generate non-normative modes of governance to (re)negotiate access.

Moreover, intersectionalities allow for a nuanced understanding of how identities across diverse social categorisations such as age, class, migrant status and disabilities influence access to water services. An intersectional analysis of people-as-infrastructure element revealed that in reference to water access in informal settlements, it largely translates to women-as-infrastructure. Further intersectional analysis of women-as-infrastructure for the South African case revealed that the 'black-female-body' was a significant element of the hydraulic infrastructure. Similarly, intersectionalities around knowledge-as-infrastructure indicated that material-infrastructural knowledge is primarily a purview of men. Therefore, everyday experiences of the governance of water services is influenced by the unique identities as well as the overlapping of identity indicators whose meaning and significance vary across time and space. Intersectionalities therefore reveal the power and inequalities arising from the unique identities and how they influence the interactions and practices of actors in relation to accessing water services.

CHAPTER NINE

CONSOLIDATION OF KEY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This study sought to investigate the modes of water governance in urban informal settlements based on the case studies of Mukuru in Nairobi, Kenya and Kya Sands in Johannesburg, South Africa. The overall finding of the study was the unwarranted privileging of the "expert" through biasing of formal policies and practices towards normative modes of water governance that fail to gain traction on the ground, especially when contested through diverse manoeuvres of everyday practices. The key findings include the role of people-as-infrastructure (social relations and the human body), the agency of human and non-human infrastructure, the role of the politics of invisibility and the transformative impact of conditions and challenges of water access on normative modes of governance in informal settlements.

This chapter aims at consolidating the overall findings and conclusions of the study through linking the research question and sub-questions as well as the conceptual framework. The chapter begins by revisiting the sub-questions which guided the research process as well as the overarching research question and working hypothesis presented in Chapter 1 to identify and consolidate the key findings of the study. It then re-articulates the original contribution guided by the key insights from the study. Further, it elucidates the significance, limitations and the contributions to knowledge of the study. It ends with the recommendations for further research and conclusions of the research.

9.2 REVISITING THE SUB-QUESTIONS AND RESEARCH METHODS

The first sub-question on the conditions and key challenges of access to, use and disposal of water was the point of departure to offer a broad overview of the situation of water services in the two informal settlements. The sub-question sought to understand the key attributes of the conditions and challenges of water access, use and disposal that can be drawn from two case studies spanning two countries to contribute to a more complex understanding of water governance. The understanding of the conditions and challenges of water services, the actors, their roles and practices as well as the inter/intra-household dynamics is useful in closing the loop and navigating back to the overall research question as well as the research problem. The literature appraisal on infrastructure, governance and practices in Chapter 2 indicated the mediating role of

infrastructure in water governance as well as the nexus between infrastructure and practices. The literature review supported an alternate definition of governance consistent with this study's argument of the transformative effect of the interactions between human and non-human elements of infrastructure. Primary and secondary data were gathered through documentary analyses, transect walks, observations, in-depth interviews with state and non-state actors and focus group discussions (FGDs). Chapters 4 and 6 articulated the empirical findings in terms of how the conditions and challenges of water access impede normative governance practices and render it unfeasible as well as how this leads to malleability in governance in Mukuru and Kya Sands respectively.

The second sub-question on the key actors and their roles in water services in informal settlements sought to identify the actors (state and non-state) at different scales in water services as well as their relationships, associations and interactions. The third sub-question explored how people in informal settlements negotiate and secure water access as well as the inter and intra- household dynamics regarding water access. Chapters 5 and 7 articulated sub-findings in terms of practices such as manoeuvres, negotiations and coercion, collusion and invisibility to transform normative governance towards ensuring access to water under challenging conditions in Mukuru and Kya Sands respectively. Chapters 4, 5, 6 and 7 explored how the dimensions of conditions/challenges, key actors/roles and their practices inform our understanding of related modes of governance of access to water services. By investigating the messy interactions of state and non-state actors, both sub-questions substantiate the interfaces between normative and non-normative water governance practices.

Finally, it can be said as a whole that the qualitative research method was appropriate in addressing the research question since it offered an opportunity towards an understanding of the everyday practices of water access and modes of governance through the narrations and depictions of the residents of both settlements. My experience of this study proved to be in line with Velzeboer et al. (2014) that examining everyday practices reveals how everyday activities are produced as well how they work in different contexts. Specifically, I was able to point out the resonances and dissonances between the narratives and observations in both research contexts as well as the documentary evidence. Therefore, it can be said that the "data of the everyday" presented in Chapters 4, 5, 6 and 7 brought to bear the conceptual framework on the research question which makes it relevant for the study.

9.3 KEY RESEARCH FINDINGS

In this section I revisit my original research question as a way of highlighting the key findings from the study: What are the modes of water governance in urban informal settlements in Kenya and South Africa? As shown in Table 9.1, the key findings and related original contribution are summarised in contrast/relation to the theoretical perspectives of leading authors whose scholarship was instrumental in guiding the study.

9.3.1 People-as-infrastructure

Critical to informing this question and of particular note from both Mukuru and Kya Sands became the realization of the prominence of people-as-infrastructure (terms of social relations and the human body) in the governance of water services in line with Simone (2004). As was shown in Chapters 4, 5, 6 and 7 the study argues that social relations (such as social networks information sharing through rumours and speculation) between actors (which are constantly (re)configured during the process of access) are a crucial component of infrastructure in gaining and maintaining access to water services. The multiple identities of people-as-infrastructure and arenas in which they operate, constructs a situation in which water governance is in continuous flux since it is based on unstable and fragile relationships. In particular, the study demonstrates the predominance of the female body as part of the infrastructure in water services provision especially for last mile delivery to their houses in line with Velzeboer et al. (2014) findings discussed in Chapter 2. Further, through an intersectional analysis, the study extends the findings of Velzeboer et al.'s (2014) to show that that the notion of people-as-infrastructure in access to water services in informal settlements is largely women-as-infrastructure.

Furthermore, as was shown by the findings Chapters, social embeddedness of access to water services depends on social relations which are simultaneously forged and severed as households endeavour to access water services to meet their daily water requirements. Across both case studies, social relations were found to be crucial for households' access water services as well as ensuring that rules that govern access to water services are followed. The social relations within and between households are fragile and can be simultaneously created or fractured during water access which often generates conflict. Comparatively, increased vulnerability of water services and fragility of the heterogenous material-infrastructure in Mukuru increases the density and role of social relations compared to Kya Sands.

Besides, since infrastructure as a 'becoming', is fluid and evolving, social relations are constantly (re)created to assure water access (Anand, 2017; Rutherford and Coutard, 2015). Thus, an incremental change in the infrastructure produces a transformative reconfiguration which creates new pathways for access to water services which, in turn generates fluid and dynamic water governance processes and specifically the emergence of non-normative modes of governance. As an ordinary part of infrastructure management to maintain water provision, repairs are dependent on technology, social and state practices, as well as situated knowledge and tools (Anand, 2017). Discussions in Chapters 5 and 7 on knowledge as infrastructure are significant and serves as a discourse for power among various actors. Further, the salience of fragmented knowledge contests the idea of the omniscient role of the state in maintaining access to water services in congruence with discussions of Bjorkman (2014) as reviewed in Sections 1.6 and 2.2.3. Intersectionalities of knowledge-as-infrastructure reveal infrastructural knowledge (technical) as the purview of men since the responsibility of repairing material-infrastructure was predominantly assigned to (or assumed by) them which thus extends findings of Bjorkman (2014).

9.3.2 Agency of human and non-human infrastructure

The conceptual framework in Chapter 2 suggests that governance comprises an assemblage of formal and informal interactions between actors with varying degrees of agency. The outcome of the negotiated interactions is dependent on the agency and the sources of power that each actor draws on. Equally, the conceptual framework shows that access to water services is sustained through an assemblage of infrastructure comprising material, people and knowledge elements and the simultaneous intertwining of the infrastructures (McFarlane, 2009, 2011). Similarly, the working hypothesis supposes that the agentic properties of material infrastructure is enhanced beyond what would normally be envisaged under normative mode of governance and human bodies become visibly embedded with the material infrastructure at the point of water access.

Chapters 5 and 7 demonstrate how the agency and local technical knowledge of the residents who carry out the repairs and maintenance of the physical infrastructure becomes articulated as knowledge infrastructure. In line with Berk and Galvan (2013), through political creativity at various scales, state actors invent new ways of executing repairs given the frequent break downs by tapping into the situated knowledge that the residents have because infrastructural adjustments are not only dependent on expert knowledge but also on situated/local knowledge. Hence, lack of situated knowledge about the reality on the ground by state officials

leads to a departure from the normative mode of water governance through the everyday practices. Therefore, a finding of the study is that invented and invited coproduction emerge during the process of water services provision particularly in the repairs by state officials and residents/water vendors. Particularly, through non-normative modes of governance, spaces are created for invented coproduction. In other words, through coproduction, governance is no longer about supply and demand or expertise and ignorance but is a process of interactions in which various actors come to terms with their varying degrees of agency. Thus, non-normative modes of governance typified by mundane and prosaic everyday practices can be seen as constitutive of urban governance which makes it possible to demonstrate the agency of ordinary people, especially those living in informal settlements. The study revealed the relationship between infrastructure and practices and their mutual co-constitution and co-evolution as residents exercise agency through various actions and practices to navigate the city in order to sustain access to water services.

The study also revealed an inversion of the roles of various actors in the governance process whereby the residents, rather than the state, are the 'experts' of infrastructure reticulation in the settlements. Thus, the study demonstrates unwarranted privileging of the 'expert' through biasing of formal policies and practices towards normative modes of water governance but notes that in reality such ideas fail to gain traction on the ground, especially when contested through diverse manoeuvres of everyday practices. Despite the differences in both study contexts in this regard, the study shows that the urban poor are not passive recipients of their circumstances but can manoeuvre infrastructure to redirect water both materially and socially. The attribution of agency to human actors (and presumption of passiveness of non-human elements) is expected in the normative mode of governance. This study demonstrates the non-normative modes of water governance whereby agency is more broadly distributed even to non-human infrastructure, including knowledge and social relations.

9.3.3 Politics of (in)visibility

The conceptual framework in Chapter 2 suggested the mediating role of infrastructure in the access to water services. The study shows the visibility of material infrastructure contrary to Heidegger's (1962) argument that infrastructure is largely invisible unless it breaks down. Further, the study shows that visibility of material infrastructure is dependent on the workings of power of various actors (and their interests) who control water services in the settlement. Importantly, the study finds infrastructure as a site of contestation, engagement and negotiation by actors to access water which creates fragility in water governance. As discussed in

Chapters 4 and 6, the visibility of infrastructure increases the intensity, unpredictability and complexity of the power relations and engagements among numerous actors. Additionally, infrastructure can be seen as a double-edged sword since it is a means of progression as well as a means of oppression. For instance, infrastructure could signal the provision of services for the residents but it also makes them vulnerable to oppressive practices such as price fluctuations controlled by actors such as cartels. Thus, the presence of infrastructure at a particular point in time does not mean that the system will always be functional or yield water. Infrastructure in informal settlements is notoriously unpredictable and may yield water intermittently due to contestations, inevitable/unintended breakdowns or intentional disconnections.

In congruence with Ekers and Loftus (2008) concept of power as diffusive and the consequence of a myriad of relations (as introduced in Chapter 2, Section 2.6), the study demonstrates that power relations influence who gets water, as well as when, how and where water flows through the settlements. Importantly, and of relevance to the research question, the study shows that other actors can dominate the provision of water services not only due to state absence but also due to state abstinence when the state avoids or ignores a problem. The study therefore shows the role of the (in)visibility practices of the state in access to water services which could deepen the understanding of water governance (Razon, 2017). As a practice, the politics of invisibility as mediated by power relations generates non-normative modes of governance which allow the state to redefine the scope of the problem at hand so as to justify lack of attention to the problem (Kuchinskaya, 2014). My findings reinforce the international literature which notes that the lack of access to water services is a complex and multifaceted process that cannot be satisfactorily explained solely by the presence of mafia-like cartels, collusion and rent seeking (Bjorkman, 2014).

Finally, while the state provides visible infrastructure as the source of water which is variously manipulated by the residents, the state also employs invisibility to avoid complex and sensitive problems such as negotiations and contestations by actors. Hence, what the state chooses 'not to see' entails power dynamics that the state renders invisible. Similarly, whereas concerns about the urban poor are included in a number of discussions and policies, in reality the poor are excluded in the actual provision of water services further demonstrating the "interplay between visibility and invisibility, seeing and unseeing" (Razon, 2017: 57). This implies a symbolic inclusion and a material exclusion of the urban poor in urban planning and implementation respectively. A key finding which could be potentially transferred to other informal settlements is the hybrid

system of normative and non-normative modes of governance in provision of water services as characterized by spaces of state absence and abstinence.

9.3.4 Normative and non-normative mode of water governance

Overall, the study demonstrated on the nullity of unwarranted privileging of the expert through biasing towards the normative water governance mode which fail to gain traction on the ground, especially when contested by the realities of everyday practices which unequivocally demonstrate agency of material and non-material infrastructure. This finding builds on Swyngedouw (2005) argument that state failure to provide adequate basic services leads to the emergence of new forms of engagement and governance. Specifically, the study shows the highly complex and deeply entwined set of governance relations and how these effect a broader understanding of the provision of water services in congruence with Zimmer (2012) argument that governance entails complex interactions between state and non-state actors. This study explored both the formal and informal mechanisms of water governance and the findings show a semblance of policy and service-level stability and coherence at the top coupled with continuous negotiability of access to water services at the points of access (see Figure 9.1). The presence of legal and institutional frameworks on water services indicates the state's intention to provide water services to people on the urban margins as shown in the findings in Chapters 4 and 6.

Chapters 5 and 7 illustrate how the discrepancies between the lived realities on the ground at the points of access and the multiple interpretations and implementation of the legislation by the actors create room for manoeuvres and negotiations among the actors. Similarly, I demonstrate that there is emphasis on resource monitoring and tracking at national as well as regional levels but minimal accountability at the points of access. As discussed in Chapters 4 and 6 the strong state presence at national and regional levels is coupled with intermittent presence and negotiable absence of the state at the micro-scale. Thus, the study demonstrates how the impedance by conditions and challenges for access to water services renders the normative modes of governance malleable by creating spaces for coproduction through a variety of tactics (Cornwall, 2000;2002). The contested interactions between normative and non-normative modes of governance especially at the point-of-access reinforce the agency of human and non-human actors in navigating water access.

The discrepancies between the practices on the ground and norms governing the access to water services can be explained by the critical role of people-as-infrastructure in access to water services (Simone, 2004). The presence of individual and collective agency implies that various actors exercise varying levels of discretion to act in ways different from what various legislations and policies or even rules demand. Therefore, water governance is typified by stability of processes at the top but volatility and elusiveness at the bottom, and more specifically at the water access points.

Based on the findings from this study, Figure 9.1 re-articulates the conceptualization of water governance by depicting the different levels of the regulatory and policy frameworks as well as the levels of water resources and services management. Further, the Figure indicates that the degree of policy certainty and rigidity and resource accountability across the various levels and the certainty and rigidity of policies and frameworks decrease as they approach the community level. Similarly, the levels of resource accountability decrease closer to the water access points.

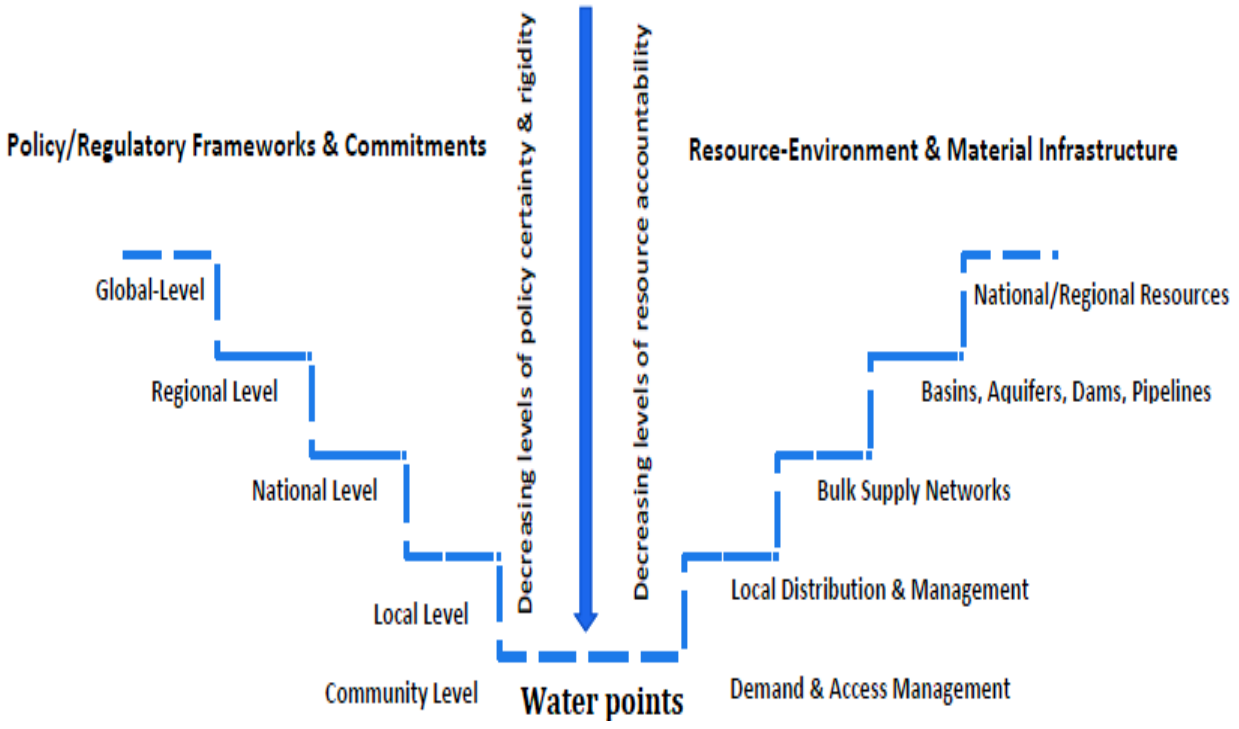

Figure 9.1: Water governance model

9.4 RE-ARTICULATING THE ORIGINAL CONTRIBUTION

I now re-articulate the original contribution of the study guided by the key insight on agency of material, people and knowledge as infrastructure in transforming normative mode of governance into non-normative mode. When normative governance encounters severe conditions and challenges of water access, use and disposal within informal settlements, it is not merely rendered impotent or useless, but it is instead transformed (through the agency of material and people/knowledge elements of infrastructure) into a more malleable mode which creates space for coproduction based on actor-tactics such as manoeuvres, negotiations, condoning and coercing which in turn yields a non-normative mode of governance for water access, use and disposal within such settlements. In particular the study indicated that the normative mode of governance is rendered malleable through the agency of both material and non-material elements of infrastructure thus generating a more fluid non-normative mode of governance which is more aligned to sustained access under prevailing circumstances in the informal settlements. This is clarified further on Table 9.1 which emerges from the following key considerations:

- On the differentiation of modes of governance in water access, which are the core studies reviewed under Chapter 2 and how far have they gone in articulating what my study finds, and therefore what are the added dimensions arising from my findings?
- On the transformation process (impedance by conditions and challenges, the rendering of malleability, the space for coproduction through non-normative tactics), which are the core studies which might have gone down this path, and how far did they go compared to how far my study has gone and therefore what is the additional contribution from my study?
- On interpreting findings in terms of transformative agency-of-material-infrastructure and people/knowledge as infrastructure, which are the core readings which might have gone along this path, and how far did they go compared to how far my study has gone and therefore what is the additional contribution from my study?

As guided by the overall answer to the research question and the working hypothesis, Figure 9.2 shows how the overall findings and original contribution differ from the initial understanding of the study. Thus, the findings led to a more nuanced and detailed conceptual framework based on the refined understanding which has emerged from the study of the governance of water services in informal settlements.

Table 9.1: Summary of the original contribution of the study

Core original contribution issue/theme	**Core studies and sources as per literature review chapter**	**Existing understanding: Extent of the consolidated understanding as per literature review chapter**	**What my study findings extends or modifies in relation to existing understanding**	**Original contribution of my study when captured back into context of existing understanding in literature**
Normative versus non-normative modes of governance – Key attributes	Swyngedouw (2005) Zimmer (2012)	State as a dominant player in a field with other players. Governance as interactions between state and non-state players.	The differentiation of modes of governance	The differentiation and understanding of the relevant attributes in the differences. Unwarranted privileging of the "expert" through biasing of formal policies and practices. Normative mode of water services governance as highly malleable.
Transformation process (conditions/challenges to malleability) – key attributes:	Anand (2017) Heidegger (1962)	The invisibility of material infrastructure. The assemblage of infrastructure elements at the "point-of-access".	Impedance of service provision by conditions and challenges of water services, the rendering of malleability, the space for coproduction through everyday practices. -Access-use-disposal loop approach in examining water services Politics of invisibility.	Destabilising effects on normative governance by the roles and practices of the diverse actors at the "point-of-access".
Transformative agency of material infrastructure and people/knowledge as infrastructure	Velzeboer et al. (2017) Bjorkman (2015) Simone (2004 Anand (2017)	Agentic properties of material infrastructure. People-as-infrastructure Human body part of the hydraulic infrastructure.	Transformative agency of human and non-human elements.	-Women-as-infrastructure -Black-female -body -as-infrastructure -Men-as-infrastructure

9.5 SIGNIFICANCE AND CONTRIBUTION OF THE STUDY

This section expounds on the contribution that the findings of this study have made to the academic discourse. The study contributes to the body of knowledge on the inter-complexity of infrastructure provision and acquisition in the informal context by giving insights in relation to everyday practices within urban informal settlements which are key issues which have not been systematically studied in the global South and particularly in Kenya and South Africa. By taking an extended notion of infrastructure that includes both material and non-material elements, this study substantiates the mediating role of infrastructure in governance of water services and shows how residents utilize the various elements of infrastructure for access to water services. The study findings thus negate Heidegger (1962) theory that material infrastructure is invisible until it breaks down. Ultimately, the study demonstrated the close relationship between how we understand infrastructure and brings a novel understanding of the different elements of infrastructure through closely articulating Simone's (2004, 2010) idea of *people-as-infrastructure* with regard to the provision of water services.

This study used case studies located in the global South to explore the everyday urban experiences and thus contributes towards more diversified urban theories. The comparative analyses across both case studies entailed extending the ideas from a single case study in order to gain deeper insights on the issues under study. Through intersectional analysis the study brought out the subtle ways in which governance manifests in everyday practices across different geographical spaces. An important finding across both cases is that Simone's (2004) notion of people-as-infrastructure in regard to access to water services in informal settlements is in reality women-as-infrastructure. Additionally, my findings show that although women retrieved the water, the repairs of the taps and pipes were carried out by men indicating that knowledge infrastructure was largely the purview of men. Through the intersectional analysis of the notion of people-as-infrastructure, the study extends Velzeboer et al. (2017) theory that the human body is a crucial part of the hydraulic infrastructure in areas without adequate provision of water services and Bjorkman (2015) theory of the embodied knowledge of the hydraulic infrastructure. Equally, the study provided insights of how people manoeuvre and devise alternatives in the face of inadequate water services thus enabling improved understanding on water governance in line with Anand (2017).

Notably, the study shows that repairs and maintenance involve both the physical infrastructure and the social relations which are continually forged and broken during water access. Previously, few studies have

investigated the distinct concerns of water services such as access, use and disposal to capture the complex manner in which the three factors play out in an informal settlement context. Critically, my access-use-disposal loop of water approach in the study revealed the dire situation of water disposal systems in both contexts hence demonstrating that a failure to examine the three dimensions of water services could often lead to fragmented institutional arrangements that do not holistically resolve the broader water challenges faced in informal settlements.

My study was in response to Bierschenk and Sardan (2013) and Dugard (2016) call for empirical evidence of the messiness, intricacies and complexities of governance of service delivery in cities of the global South. Similar to the data evidence from my study, their call emphasise that governance is a collage of multiple dimensions and practices by different actors. The presence of such evidence is critical because understanding the intersections and interactions of the state and non-state actors can enable better formulation and implementation of policies in line with Zimmer (2012) argument of governance as the interactivity between state and non-state actors. Through empirical research, I built an understanding that affirms the agency of various actors and explore the factors that enhance or inhibit their respective agency. The study revealed that the political creativity of state actors (including discretion on application of top-down rules) enables them to transcend structures by exercising local-level agency. By going beyond the duality of agency and structure, state officials dismantle orders and find new ways of implementing the frequent repairs needed through the practice of coproduction. This contribution is in congruence with Swyngedouw (2005) view that new forms of governance emerges in order to fill gaps in the provision of basic services. These insights from the study have been applied towards a reiteration of the conceptual framework as shown in the updated version shown in Figure 9.2.

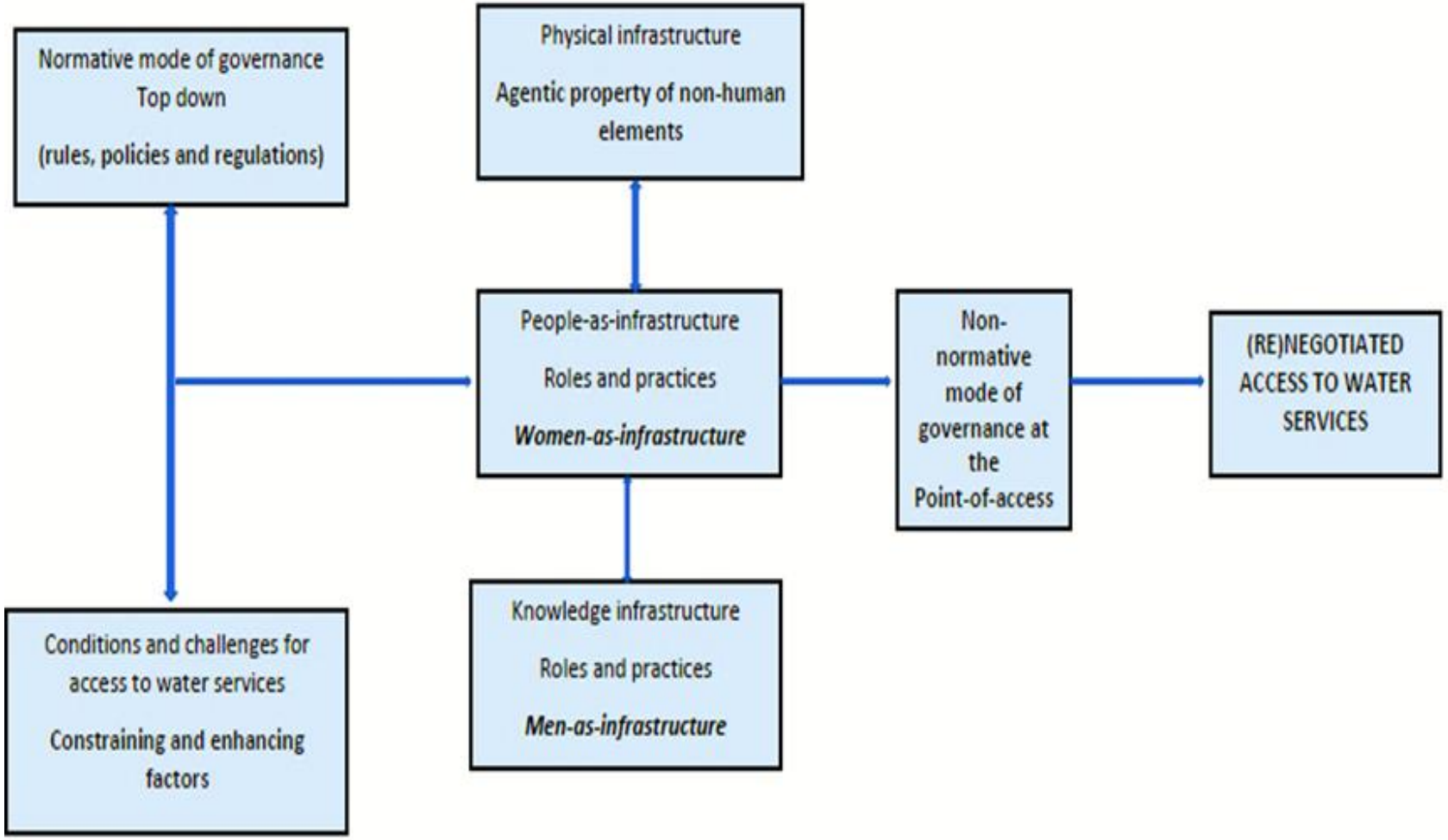

Figure 9.2: Updated conceptual framework reflecting findings and contribution of the study

9.6 LIMITATIONS OF THE STUDY

The scope of the study was limited by both time and resources, and, therefore, did not address all the governance issues areas that relate to access to water services in urban informal settlements. This Section presents the crucial limitations of the study.

Governance versus supply-side sustainability and constraints: As with previous studies (Anand, 2017; Bjorkman, 2015) discussed in Chapters 1 and 2, this study focused on the demand side approach to the provision of water services. The study could have investigated the impact of water governance in some cities such as Cape Town, South Africa that has recently experienced severe and protracted water crisis triggered by supply side barriers such as climate change related factors and finite or declining water resources against population increase. Such an approach could reveal how the supply-side sustainability and constraints could be managed to mitigate crises in the future.

Longitudinal studies involving sequenced data over multiple time-periods: Owing to time and resources constraints, the study took a cross sectional case study approach in which data were collected at one point in time. A longitudinal study involving repeated observations of the same variables would have offered enhanced data on the long-term trends, evolution and patterns of modes of water services governance as well as aspects of the role people-as-infrastructure in access to water services. The trends and evolution of practices are important in deciding the interventions that would help ameliorate the situation. Similarly, since the time for data collection could not be sufficient (eleven months in both settlements) to gather all the experiences of residents with regard to water services, documentary analyses of secondary data on the study areas were carried out to fill in gaps in the experiences and practices of the residents with regard to water services. Equally, in view of the 'old' age of the data on the population census (2011 and 2009 in South Africa and Kenya respectively), aggregation of census data and the bureaucratic hurdles of access made it difficult to gain finer details of the last censuses. To overcome this challenge, secondary data and other internet sources were used to extrapolate and thus update the critical data sets.

A key finding of this study was the role of people-as-infrastructure in access to water services. However, it was not possible to explore in detail how the cultural representations of the residents of informal settlements influenced social relations as well as 'whose' human body was ultimately engaged in procuring water services at a more granular level. The study investigated water governance in urban informal settlements. However,

it did not examine how, when and if the state engages the knowledge-infrastructure of the residents towards maintaining access to water services as well as the role of informal service providers and the related governance issues for other basic services. Likewise, the study sought to understand the role of state and non-state actors without elaborating on the extent of their contribution and influence on access to water services. Similarly, only actors in water services were investigated without factoring intersectionalities with governance in access to other basic services such as electricity/energy, transport or housing in general.

9.7 RECOMMENDATIONS FOR FUTURE RESEARCH

Arising from the nuanced findings, original contributions and limitations of the study, the following challenges and concerns have been prioritised for further research.

Longitudinal study extending beyond a single timeframe: One of the critical perspectives recommended for further investigation is a longitudinal study employing both qualitative and quantitative methods which would allow iterations of planning, executing, observing and reviewing the impact of various interventions towards improving water governance in informal settlements. In particular, since informal settlements are heterogeneous, it would be useful to carry out longitudinal studies on how water services are governed in other cities in the global South and thus draw comparative insights towards an enhanced understanding. This echoes Caldeira (2017) argument that informal settlements should be studied across space and over time in order to understand reproduction of space and inequalities as well as the evolution of the process of service provision.

Cultural representations and people-as-infrastructure: Further research could be carried out to investigate how the cultural representations emanating from the diversity of residents in informal settlements influence the roles of people-as-infrastructure. Such research would deepen the understanding of the factors that influence the agency of human and non-human infrastructure. Similarly, given that the study pointed to the crucial role of knowledge infrastructure in gaining and maintaining access to water services, it would be valuable to understand the cultural influence over how the knowledge is gained and leveraged beyond the gender dimension covered in the study.

If and how the state engages the knowledge of the residents in governance for access to water services: Whereas data on this issue has been covered in this study, the focus has mainly been on when the state

taps into residents' knowledge in a reactive manner, but without exploring if at all there is a proactive appreciation of the need for consistent and meaningful leveraging of such knowledge by the state. Further research could therefore examine the extent to which states proactively choose to harness the infrastructural knowledge of the residents in a systematic way rather than being merely reactive. The extent to which decentralized and personalised knowledge fragments governance of water services could also be investigated. For instance, what role might ignorance by various actors serve in water services governance in urban informal settlements?

Role of informal service providers and related governance issues in other services: Given that the role of the state in water services provision is salient in both cases through various instruments and specific actions such as installation of the physical elements of the infrastructure, additional research could be undertaken to explore the role of informal providers of other basic services such as housing, electricity, sanitation and security as well as their relations with state officials. The investigation of the interface between the state and informal services providers could extend the understanding of the emergence and complexities of informality in basic services provision. A comprehensive study on the impact of state and non-state actors' interactions on the residents who rely solely on informal service providers could further deepen the understanding of water governance. Acey (2016:29) argues that "….the most significant gaps in the literature in infrastructure investments, access, and governance concern the operations and scope of alternative providers (and how they interact with state services)". For example, to what extent could the savings groups in Mukuru eliminate or mitigate the negative impacts of water cartels in the settlement through diverse actions such as mobilising communities and lobbying the state for better services?

Politics of (in)visibility of the state in relation to other services: It would be worth exploring the extent to which politics of (in)visibility by the state manifests in access to other basic services in informal settlements. Such research could reveal the variations in state absence and state abstinence in the provision of various basic services.

Similar governance issues in relation to waste water disposal, especially in view of pandemics such as Covid-19: Arising from the hazardous nature of wastewater disposal and the health challenges this poses in informal settlements, further research could investigate the sustainable ways of resolving the problem through mechanisms such as community involvement and technologies of wastewater recycling and reuse.

Additionally, the recent global outbreak of the novel Corona Virus Disease (COVID-19), revealed yet another intersectionality of adequate water services and the governments' as well as international health protocols for mitigating the spread of the disease. Given the exceptional and disruptive nature of the pandemic, such a study would shed additional light on how the severe inequality and inadequacy of water services provision interacts with inequality in access to both preventive and medical health services in the global South. Specifically, the water-state relationship and its role in the pandemic would be interesting to articulate further given the state-driven public health protocols of hand washing in the context of unequal access to water services.

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APPENDICES

The table below presents an overview on the content of the various appendices. The first section of the appendices has been arranged according to the various data collection methods and analyses employed. The second part contains various approvals for the research.

Table A0.1: The overview of the appendices

APPENDIX	DESCRIPTION
Appendix 1	Summary of socioeconomic characteristics of the respondents
Appendix 2	The FGD process, schedules, guides as well as sample responses (see details of the FGD in Chapter 3 and transcripts in Chapter 4,5, 6 and 7).
Appendix 3	Sample responses from household interviews in Kya Sands and Mukuru.
Appendix 4	Sample responses from key informant interviews with state officials in Johannesburg Water (JW) and Nairobi Water and Sewerage Company (NWSC).
Appendix 5	Excerpts from the researcher's field diary.
Appendix 6	Photographs taken during the field work in both sites, showing abandoned infrastructure, modes of water disposal employed and practices around the tap in Kya Sands.
Appendix 7	The research methodology in form of a matrix for the sub-question on actors showing the research instrument, the key data parameters, summary of responses as well as the data analysis approach employed. The matrix formed the basis for the discussions in Chapter 6.
Appendix 8	The transect walk checklist.
Appendix 9	The interpretations of various sections of South African legislation on water services.
Appendix 10	The screenshots of data analysis using Atlas ti software
Appendix 11	The research approval letter from JW.
Appendix 12	The research approval letter from the National Commission for Science and Technology and Innovation (NACOSTI), Kenya
Appendix 13	The ethics clearance certificate from the university of the Witwatersrand consistent with the ethical requirements elaborated in Section 3.11 in Chapter 3.

APPENDIX 1: Summary of the Socioeconomic Characteristics of the Resident Interviews

Variable	Mukuru (Total 22) Frequency (Percentage%)	Kya Sands (Total 24) Frequency (Percentage%)
Gender		
i i. Male	7 (31.2)	4 (3.5)
ii ii. Female	15 (69.8)	20 (96.5)
Family size		
i i. Less than 2	1 (4.54)	0 (0)
ii ii. 2-5	18 (75)	15 (62.5)
iii iii. 6-10	3 (13.63)	5 (20.8)
iv iv. 10+	0 (0)	4 (16.7)
Age of Respondent		
i. 18-35	12 (54.54)	16 (66.7)
ii. 35-60	7 (31.2)	7 (25.9)
iii. 60 and above	3 (13.63)	1 (4.17)
Education level of Respondent		
i. Primary	5 (22.72)	17 (70.8)
ii. Secondary	16 (72.72)	6 (25)
iii. University or College	1 (4.54)	1 (4.17)
iv. Informal Education	0 (0)	0 (0)
Income Level (Monthly)		
i. Kshs5,000-10,000 (Zar. 2600-3500)	17 (77.27)	20 (83.3)
ii. Kshs10,000-20,000 (Zar. 3500-5000)	4 (18.18)	4 (16.7)
iii. Kshs20,000 and above (Over Zar. 5000)	1 (4.54)	0 (0)
Are you on social grant?	N/A	20 (83.3)
Yes		4 (16.7)
No		
Years in settlement		
i. 0-5 years	12 (54.54)	13 (54.17)
ii. Over 5 years	10 (46.46)	11 (45.83)

Occupation of respondent i. Employed ii. Unemployed iii. Employed with business iv. Self employed v. Stay home parent	 5 (22.72) 6 (27.27) 3 (13.63) 6 (27.27) 2 (9.09)	 5 (20.83) 11 (45.83) 0 (0) 2 (8.33) 7 (29.17)

APPENDIX 2: FOCUS GROUP DISCUSSIONS IN MUKURU AND KYA SANDS

Purpose	Focus group discussions (FGDs) allow people to express their opinions and attitudes towards a particular issue of concern in a free and natural setting. The FGD followed the process of; • Engagement questions by introducing and explaining the rationale of the topic to the topic of discussion; • Exploration by getting the participants to discuss the topic; • Exit questions to wrap up the discussions by ensuring that all the aspects have been covered.
Objectives	The key objectives of the discussions were as follows: • Explore the challenges and conditions of water services in Mukuru. • Examine the sources of water in the settlement and the characteristics of the water from each source. • Describe the impact of the water situation on the household, neighbourhood and village level. • Explore possible solutions to the water services situation.
Protocol	As the facilitator and researcher: At the beginning of the FGD, I welcomed the participants to the forum and explained the nature of the dialogue session. During the FGD, I ensured that research questions were adequately covered within the time stipulated in the PIS. Additionally, I ensured that the discussions were inclusive by

	drawing in all the participants to give their opinions. While respecting their freedom, each participant was given a chance to express their opinions or views about each question. At the end of the discussion, I thanked all present for their time and contributions at the close of the event. The responses that were recorded from the discussions were later transcribed by my research assistant who was present at the discussions.

APPENDIX 2a: Mukuru Focus Group Discussion Schedule

Venue: Mukuru Christian Celebration Church, MCC village

Date: 29th August 2018 and 20th October 2018

Time	Activity	Person in charge	Remarks
10.00 am-10.15 am	Arrival and registration Assigning of pseudonyms	Beatrice	Registration Issue name tags
10.15 am-10.30 am	Introductions and welcome remarks. Setting the stage. Managing expectations	Irene	Contextualizing the FGD within the water situation and its impact in the settlement. Ensures that the meeting runs smoothly.
10.30 am-12noon	Engagement, exploration and exit questions. See discussion guide in Appendix 1b.	Beatrice and Irene Beatrice to record the discussions on a flip chart.	
12 noon-12.15	Summary of the discussions	Irene	Summarise the main themes discussed and ask participants if they are well captured.

			Thank the participants for their time and inputs.
12.15pm to 12.45pm	Refreshments served. Departure	Irene and Beatrice	

APPENDIX 2b: Focus Group Discussion Guide employed in Mukuru

Water governance in Mukuru informal settlement

A. Water situation in Mukuru

1. What is the understanding of the participants about the water situation in Mukuru? What has led to this situation?
2. what are the sources of water in the settlement? For each source, please discuss the: Reliability,
3. Price, Quality
4. The frequency with which you use it
5. Who controls the source of water? Who has power over each source?
6. What factors influence your choice of that source?
7. Which of the sources is your preferred option?

B. What is the effect of the water situation on the residents at the:

1.Household level

How do you reason or rationalize your water usage?
How do you ration the water?
What behavioural adjustment or modifications have you implemented

2.Neighbourhood level

3.Village level

Relate some of the most challenging encounters that you have had with regards to water in Mukuru. That is describe a situation that you really found difficult in accessing or disposing water in the settlement.
What changes have you experienced with regard to water over the past 5 years in Mukuru.

C. Solutions to the situation

What interventions have been implemented in the settlement and what do you think about them? Evaluation of the different interventions.
What technical, governance, political and environmental solutions do you think could be implemented to resolve the problem in Mukuru?

Probe what? why? who? when? how? how much are you willing to pay for the solution?

APPENDIX 2c: Focus Group Discussion in Mukuru

Areas represented: Zone 48, Wapewape, Imara Daima, MCC, Motomoto and Sisal

Questions	Responses and description
1.Discuss is your understanding of the water situation in Mukuru?	P1: The water pipes here go through the open sewerage system. So, we consume contaminated water. P2: Water here is a big problem because of poor planning in this area since it is an informal settlement. Only cartels benefit from the water supplied here. NWSC does not get any benefit, so they do not see the need to follow up on it. So poor planning by NWSC of water supply in Mukuru kwa Njenga and Embakasi is the main challenge. Also, since we do not own the land we have settled in, provision of these services is difficult because these structures could be demolished any time. Water connection is also a serious problem especially caused by cartels. P3: The water we use is not safe. For example, we might have a broken water pipe in a sewer system, when it is repaired the sewerage definitely gets into the water pipe. So, we always use dirty/contaminated water, it always has foul smell. The cartels contribute to careless connection of water pipes encouraging supply of contaminated water. P4: I moved into this area recently and by the time I was moving in there was good water connection by NWSC. Later the water was disconnected. We tried to follow up but nothing was done for 3 weeks. We therefore had to seek help from cartels. Here, if you depend on NWSC, you'll never get water. P5: The Kisii water company is responsible for water supply to Mukuru. These are cartels who work together with NWSC because whenever we report a case to the company, the cartels approach us claiming we reported/ 'sold them' to the NWSC officials. So, the two work together making people hesitate to complain about water. This situation has affected me personally because I sell vegetables since 2007 and at the time, I could get to my stall on time but had no water. I had to go all the way to Tassia to get water before opening the business. I lost customers because instead of opening the business normally at 7am, I used to open at 9am. With the cartels the water is available, but it is expensive. P6: "I never used to boil drinking water but after I had body rashes which the doctor said were caused by consumption of contaminated water, I started boiling.

	P7: The cartels are a family ring. What happens is that the father makes a water connection for his son and demarcates his business territory. Likewise, the son gets other family members under his network to expand the network. The network can be so extensive that the water business in Mukuru is run by the 'big five' comprising five brothers with about a thousand agents (usually the youth) operating under them.
2.What has led to this situation? P2 had mentioned due to the informality of the area, the County is not concerned. Any other reasons?	P2: The CGN is not responsible. They constructed business stalls for us and connected us to water supply but later the pipes were stolen. We reported but they did not follow up. The water tanks are now broken, and we have never had water since then; it is over 9 years now. They even constructed ablution blocks, but they are very dirty due to lack of water, but people still use them. P4: Tribe-based groups have been formed which affects water supply because water cannot be provided before going through these specific groups. Failure to consult these groups causes fear and threat of insecurity, so many people have died because of this water. So, when you follow the proper channel, they cut your water supply. People who go through these groups are the only ones who get water supply. P1: Yes, and you must go through them to get water. When you get water through the right channels, the cartels cut the water supply overnight. P2: You see the cartels operate in a very large group. They work in close coordination even with the administration officials (police). They start as a small group of families; where a father illegally connects the son to the supply and this later expands to large groups. P3: From 2002 when I moved in, there were few people selling water but now they are so many. At that time water was being sold at Kshs. 3 and at the end of the day you collect a lot of money. Today the water is sold at Kshs. 5 but at the end of the day the vendor collects very little money due to high competition. P5: Cartels connect underground water pipes and thus one cartel sells water to very many plots. Therefore, the vendor will not have customers since the residents received water supply overnight from cartels. P6: There was a time I did not have water for 3 weeks, so I went to seek help from a supplier. He agreed to supply water on condition that I would not let the other suppliers know. That means getting water from him meant decreased the profits the other suppliers. So, in short, there is a hierarchy in water supply by the cartels (there is the head and other junior suppliers, junior suppliers supply water secretly).

3. Do you mainly depend on cartels for water services?	P6: Yes, because the NWSC pipes do not have water, they do not respond anyway so we are totally stuck.
4. Apart from piped water, what other source of water do you have here?	P3: Here we have about 4 boreholes; St. Mary's, Apostolic centre, Embakasi Girls and the one at the Chief's office. But getting water from them is very difficult. In any case all of them are broken down currently.
5. What are the uses of borehole water in the house?	P1: All household chores even cooking. It is salty water, but we do not have an option. But it sometimes creates problem because when the cartels find out the borehole operators are selling at a cheaper price, the boreholes are vandalised and there is no more water. Other times it is drastic, and people get killed. In fact, one person was murdered some time back over water.
5. How do you use water within the household?	P2: We economize water use. Because if you have fetched 7 Jerri cans, that should be enough for 7 days unless when laundry is being done. P6: Yes, it depends on whether laundry is being done and the amount of clothes that need to be washed. I use 4 Jerri cans for laundry. P2: We recycle and maximize the use of the water as much as possible; For example, after washing we use the water to clean the house, then use it again in the latrine.
6. How much would you pay to fill your water tank?	P3: That is a personal agreement with them, a monthly agreement. Varies between 1,000-20,000sh. The water vendors sometimes make profits but often they make losses. P4: In some places prices are Kshs. 5 or 10 while here it is Kshs. 20 which is unfair because this is in same settlement. P5: From my personal experience people pay 15,000 to 20,000sh per month. But most plots here do not have tanks. They purchase in Jerri cans.
7. Are there conflicts at plot level because of water?	P4: Yes. You have to check the number of Jerri cans others are fetching because we have to control the amount being fetched in case the water gets finished. This presents many chances for quarrels among neighbours. P2: In my case, it does because I live in the informal parts where we do not have high-rise buildings. So, the money affects your access to water and some people steal water from their neighbours which causes fights to break out.
8. What changes have you seen in the water situation?	P3: The situation is better than before because now you can access water though it is expensive. We do not walk long distances to get water even if

	we use cartels to get water. But in order to improve the water situation, the CGN should provide a wider and better pipe to allow more water to flow because the population has increased. Then we need more boreholes where the residents can easily and efficiently access water. Then security should also be improved. Road network should be improved. Lighting should be improved since it ensures security. Here we use illegal connections, and this should be changed. P5: I have lived here for a long time, from 1975 because I even schooled at Kayole. We used to fetch water at Kenya Power, Crescent and Vision companies. The Indian at Crescent Company allowed us to fetch as much water as we wanted. Therefore, water challenges started as the village started to grow. But the main cause of water challenges is NWSC; because water is available but there lacks a proper arrangement for residents to access water. So, NWSC should take charge to help us.
Do you think that the voice of residents is strong and can bring about change?	P2: We talk but no one seems to listen to us. President Kenyatta actually visited this area and assured us of security of tenure through title deeds but nothing was done after that. P4: Whenever we talk to other government officials, we are given many promises but these promises should be written documents so that the leaders in charge can follow up after the conversation. P7: NWSC should install water pipes and meters properly, then monitor operations so that we are not charged for water we do not even use. They should follow up if each water pipe and chambers are supplying water.
10. Any other solution?	P7: NWSC is the solution because from an individual level, you cannot provide a solution because of the cartels. NWSC should involve the residents and work in good partnership with residents and the government to provide efficient water supply. They should also restructure their offices so that we get new administration here. Within this they will dismantle water supply by cartels. But there was one administrator who tried to bring change, but he was shot by a youth from the village and died. P2: The community at large should give the management of water to well recognized and registered community-based groups. That way everyone gets to benefit. P7: Water pipes should be installed at places where everyone can see to and sensors fitted discourage cartels from cutting off water supply. There was a time a guy was cutting off a water pipe and I called Mailu who is part of the Monitoring team at the time. The culprit was arrested but he was released after giving some money to the police. The chiefs are corrupt are controlled by the cartels. So, we are helpless.

	P6: They should install surveillance system to monitor the operation of the pipes. These should be linked to their offices so they can detect when the pipes are being tampered with. P1: If only people could go to Ndakaini and see how water is being cleaned and wasted, you would not want to waste even a drop of water. It is a very expensive process and the people there are very dedicated.
11.Any other thoughts before we wind up?	P3: Water is life and it is the responsibility of NWSC to work with the community and provide water. They should hold meetings with the community to get solutions. The projects which were started long ago and have become dormant should be rehabilitated to improve the situation. P1: The people have been very keen and always report cases of water leakage and broken pipes to NWSC, but they do not respond. So, the problem is the company, and they should take charge. P5: NWSC could be hesitant to provide water connectivity due to the rumour and politics going round because Chandaria is selling land to residents; there are very many cartels involved in the land issue so infrastructure cannot be provided. We are not even sure if the person asking for the money is the real owner. P4: Urban migration has led to increase in population and thus CGN and the government know the existing population in this area and how much water each person should consume. They should respond accordingly and provide water for the population. Community should be engaged in workshops through the area chief on the benefits and rights relating to water use and supply. Lack of security of tenure affects our investment and thus the government should help the residents and also notify them of every decision they take. The government has the ability to do that. P2: Water issues should be looked into because we are really suffered. We should be provided with clean water and the pipes should be properly installed and should not pass through sewer lines. P6: Provide pipes that cannot be cut off and NWSC should disinfect the water.
Now this is the wrap up session.	P4: We had a good discussion. We first looked at the challenges we are facing in water supply. The first aspect we looked at is security. We have tribe-based groups in the community who have taken control over water supply. The village administration (chief) works together with these groups.

	Cartels offer the chiefs money and when they are operating in the water sector, the residents suffer but they continue to operate without concern because their interests are being served. Earlier we had some challenges, but we used to access water at a very low price but now the price has gone up. There is fear/insecurity when someone is providing water through boreholes because cartels come and vandalize the facility because they feel they are the only ones who should provide water. Boreholes have water but the residents cannot access because they are all broken down. **Solutions** •Complete restructuring of the administration of NWSC. •Involve the public so that residents will know their rights concerning water. •Use technology to monitor their water pipes to avoid vandalism even if they use more resources, at the end of the day, the residents will get more water. P16: I would like to add that we also discussed on how the residents can be involved. They use workshops and meetings through the area chief to engage the residents. They should also use CBOs and SHGs because they are well organized. Also at least 10m wells should be constructed as an alternative water source apart from NWSC. Then the water should be sold at Kshs. 5 for 2 Jerri cans. The government has power and should take control of what if going on in the village.

APPENDIX 2d: Focus Group Discussion in Kya Sands

Questions	Responses and description
1. What do you think about the water situation in Kya Sands and what led to the situation?	P3: I do not like it because one has to walk to the tap to collect water whether the weather is cold or hot. Living in the settlement is not our choice but due of lack of money. There is no life in the settlement. it is too fast and full of crime. P6: The situation is bad because people are not responsible. People waste water and use the pressure of the water to wash their clothes. People do not respect the rules and therefore they do not behave well. For example, compared to 5 years ago, there is more damping around the tap. The leaders are no longer giving warnings about the behaviour around the tap. P5: We have to fetch water at the tap and when you fetch it you treat the bucket like a tap. But then you cannot keep going to the tap all the time because it is tiring and time consuming. I fetch water once a week about 80 litres because I live alone. We are accustomed to using things sparingly because of lack of money so even water is used sparingly. P7: The drainage where we dispose of water is a hazard because the children play there. This should talk to individual consciousness, but it does not work that way. During the day people behave well but at night the dispose water and solid waste however and wherever they please. P10: In the last 5 years subsequent projects have used inferior material due to vandalism and the new installations are already broken. So, you have a lot of leaks all over the settlement. P2: I also want to say that sometimes a single water point only 2 taps are working out of 6. This means that you have to queue to get water. depending on the weather, it can be quite uncomfortable.
2. Discuss the main sources of water in the settlement is the water stand? Comment on the reliability, price, quality and the frequency with which you use this source.	P4: I think that the water is not safe because the standpipe is near a garbage damp, so the conditions are unhygienic. The standpipe is also not safe as there are thugs who hang around the standpipes. P8: In terms of quality, the water comes out white indicating that it has been treated. I trust the water. P9: My husband is the one who goes for water at the standpipe and the number of times he goes to the tap depends on the storage capacity in the house and what I am planning to use the water for.

	P10: Recycling or reusing water is out of the question as the water is always available and it is free. We use clean water even to water vegetables and flowers.
3. Who controls this source of water? Who has power over this source?	P1: The politicians, mainly councillors are the main players in water management, but they make empty promises because political solutions do not work. People have lost faith in their leaders since they misuse the money. P6: Personally, I would say that the committee plays a big role in the settlement is the settlement committee. The problem is that the political affiliation among the different committee members makes it difficult for projects to succeed because each brings their own political motivations. The committee is not a black and white affair and do not even have an office. There is a lot of infighting among the members. The committee is elected by show of hands. There are conflicts between the new and the old committee members. We are not sure about the positions of the committee because the elections are informal. Leadership in the committee depends on their economic status of the people. Previously there was a good system for electing the committee but then they stopped being truthful. But people who wanted to be leaders manipulated the system so that they could access and stay in power- you know…"the Mugabe system". Once in the committee they do not want to leave because of the benefits that they derive from being members of the committee. P8: The previous chairman of the committee was very strict, and people could not leave their clothes on the mouths of the taps or have taps that were not working for a long time because he would fix them. P4: JW provides water to the settlement.
4. What is the effect of the water situation on the participants on the: Household level?	P1: I quarrel with my boyfriend when he uses a lot of water and himself does not fetch water. P4: In my house we never quarrel about water because there is always water in Kya Sands. P8: I get annoyed with my sister because when I go somewhere, and the water in the house gets finished and she waits for me to come back and she is not disabled. She can go to the tap but she does not.
5. What is the effect of the water situation on the participants on the: Neighbourhood level?	P3: Conflict is common in the yards and between yards usually about the disposal of dirty water inside one's own yard or outside other yards especially when the drainage is stagnant. P7: I am not happy about the water disposal situation as the place is wet and one never knows where the water comes from. I do not know who as caused that mess.

	P2: Conflict also arises when a neighbour refuses to give water at a time when you were in need and now you want to revenge. For example, you might take that conflict to the tap while doing laundry or fetching water. Your neighbour might just say "you have taken too long" and then the quarrel begins. In section C we have fewer taps compared to other sections, so the chances of picking quarrels are quite high. P8: There are no conflicts of disposal of water with my neighbours because my neighbours and I have come to agreement on where to dispose water. But before we agreed on what to do, we have many arguments.
6. What is the effect of the water situation on the participants on the: Village level?	P5: As we live close by the river, the water disposed by people from the hilly parts of settlement usually comes into our houses. This causes a lot of discomfort because the water is dirty and it stinks.
7. Relate some of the most challenging encounters that you have had with regards to water access and disposal in Kya Sands. That is describe a situation that you really found difficult in accessing or disposing water in the settlement.	P10: We have challenges with the neighbour who is on a wheelchair and he disposes water anywhere. We understand but the place really gets murky. We have accepted him as he is and we have learned to help him to avoid.
8. What solutions do you think could be implemented to resolve the problem in Kya Sands?	P8: First of all, we need to design a program of fixing broken pipes or leaking ones. It takes very long for JW to repair the taps and pipes and so water is wasted. We sometimes volunteer to make the repairs but the search for technical and professional guidance proved futile so we carry them out in rudimentary ways. P1: I think that a holistic view of the situation needs to be taken as opposed to a piece meal approach to service delivery. For example, if we have proper stands and people built their own houses. Having taps in the house is good but there are too many people in the settlement. I think that tap water would change this place into a township which would be a great thing to do.

APPENDIX 3: IN-DEPTH INTERVIEWS

APPENDIX 3a: Household Interview in Kya Sands

A female respondent of a household of 2 adults, no children. She is unemployed. She has lived in Kya Sands since 2018.

Interview date: 24 November 2018

Location of interview: Kya Sands, Section D

Time of start of interview: 12 noon

Questions	Responses and description
Conditions and challenges of water access	
1.What is your main source(s) of water? Probe for the reliability, quality and quantity	Tap at the Corner *(Pointing in the direction of the tap).* The water is reliable, in terms of the quality and the quantity the water is okay, the tap is located just around the corner, not far from my shack. I really do not know how many times I go to the tap to get the water because I just go whenever I need to get the water. I use about 40 litres per day which also overlaps to the next day morning. When there is no water, we cannot predict the price changes.
2.Who is responsible in your household for collecting or ensuring water supply for household consumption?	I am the one responsible for fetching water in the family, although my boyfriend sometimes fetches. But mostly I am the one who fetches most of the times.
3.Tell me about your day and how you use water on a daily basis? Narrate since you get up till you go to bed….	Firstly, in the morning after I wake up, I will go fetch the water which use to bath. Next, I clean house and the utensils. When it is the day to do the laundry, I use the water to do the laundry. My husband uses the water that is left form the previous day to bath before he goes to work in the morning. I use the "Prema- Stove" to boil/ warm the water since none of use likes to bath with cold water.
4. Who is responsible for disposing water? Where do you dispose water? *How about urban agriculture?*	I am the one responsible for disposing water in the family. I dispose the water just close to the tap because since I arrived in the settlement, I found everyone doing it so I think that it is the norm to dispose the water at the tap. I store the water in a bucket and when it gets full, I go to the tap, there is a drainage that a few of us came together to dig and that is where I dispose the water. Yes, I do have small flowers in the yard, but obviously I would not water them with the used water, as it might not be suitable for the

Are there rules about water disposal in the settlement?	growth of the plants…. I prefer to use clean water for irrigation, I use water for one purpose and then after using it once I store in a bucket for disposal later. I do not recycle or re-use water. I have not heard of any rules since I came, here remember I am still new in the area.
5.How did you feel during water shortage?	There has never been a day, when I experienced water shortage since I came to stay here. Although I have not experienced water shortage here, it is obvious that water is life, almost everything, every house chore needs water, so if I were to wake up and I find that there is no water, it means I will not bath, I will not eat, I will not clean and I will not drink water.
6.Sense of agency: Do you think that it will be possible to have tap water in your house?	I think that it is possible to have the individual taps in our houses, I will really love that… Look in as much as we do not struggle with water, communal taps are not hygienic for example some people when they are doing laundry the put their underwear on the mouths of the communal taps, therefore having your own tap will be nice as everyone will have to take care of their individual taps and at least avoiding unhygienic practices at the communal taps.
7.Are you comfortable with the arrangement of fetching water from a water point?	Yes. I obviously would love to move out of this settlement, not necessarily because we do not have water, but firstly because you can see here there is not space, we are very congested, also we do not have proper drainage which leads to the stagnation of dirty water in our passages and hence this awful smell you are experiencing now. For example, some of the people go to an extent of disposing human faeces in this drainage. I am comfortable with the arrangement of fetching water from the taps because they are not that far but obviously, I would love to have a tap in my house if possible. I am just happy we do not experience frequent water cuts.
8.Who usually makes decisions about water distribution in the house?	I am the one responsible for the distribution of water, mainly because I am the one responsible for almost all the chores which require water use. I am the one cooking, the one who boils for my9 husband to bath, so in a way I am the one who decides who gets how much water.
9.How does the water situation in this area affect you and your family?	No, we never have conflicts with regard to water and its usage in the house, we are happy with the current situation and set up in the family. The advantage is that water is always available.
10.Quality of water. Do you feel safe when you take water from a standpipe or a tanker?	Because the water is from NW I think it is safe, sometimes it comes out white, and we are told it is the purification. So, the water is safe, we do not even boil it, however I do not know from which dam is this water coming from. For as long as the water comes from JW we are safe.

11. Are there rules in the settlement regarding water disposal? Who issues these rules?	I do not think there are written rules with regards to water usage and disposal, I think as human beings it is our responsibility to make sure that we protect and take care of our taps, at the end of the day they benefit us. Or maybe I am wrong, but since I came here I have not seen anywhere where they talk about rules which govern water matters in this area.
12. Are there meetings held in this neighbourhood to discuss issues related to water?	There are no meetings to discuss water issues or let me say have not heard of any. But many times in other community meeting people are constantly complaining about the water drainage.
13. Where do you lodge your complaints when you have no water?	I do not have any complaints myself about the water situation except the drainage. People do complain but I have never complained.

APPENDIX 3b: Household Interview 1 in Mukuru

A married female respondent of a household of 4 (2 adults and 2 children). She is a food vendor while her husband is a casual worker in a nearby factory.

Interview date: 20 September 2018

Location of interview: Mukuru, Zone 48

Time of start of interview: 2 .00 pm

Question	Response and observation
1.What is your main source(s) of water? Probe for the reliability, quality and quantity	Water is rare, it is with the few and it is expensive. We have no piped water in the house because would make the rent exorbitant. The situation of water is poor in the settlement. It is hard to find water and water is run by the cartels. The price fluctuates at no notice. Water has owners and the weather dictates the availability of water. The quality is questionable because of contamination from sewage water. Also I only give my children boiled water. The availability of water is unknown. We always have spare water because of the uncertainty of finding water the next time that we will find water. There is no control board hence there is no assurance that the water is clean. Usually, I buy 4 jerricans of 20 litres daily which is enough to prepare breakfast, shower, to cook and wash dishes for everyone.
2.What other sources do you have?	I do not trust any other water sources. There was a water vendor who captured rainwater in a hole (later the residents referred to it as “Shimo la Maina”) that he dug in the rainy season and pump it into a tank and

	sold it to people. That water has a taste and it has different tastes depending on the source. When there are shortages the prices go up and I postpone washing clothes. We also have some boreholes but they are not working only the one at the mosque which is used for the ablutions for the prayers. The one at the church broke down.
3.Who is responsible for ensuring that there is water in the house?	I am the one responsible for fetching water. But whoever uses water disposes it. However, we do not just dispose without reusing it several times.
4.How do you feel when there is no water in the settlement?	I feel bad when there is no water because of the effort I have to put to go around chasing for water. I have to walk to the place; stand on queues; carry the water home, which has cost me Kshs. 50 per jerrycan. On top of it I have to buy bottled water for drinking when there is severe water shortage just to ensure that the children are not sick. When there is no water I feel like an orphan and that the government has forgotten us. I feel discriminated against and not recognized as a Kenyan. I have to look around not even sure that I will get water. It is both tiring and frustrating. The feeling of frustration ends as soon as you realize that you have to go out and look for water ourselves. Basically, you are on your own.
5. Where do you store the water?	The water has to be stored in the houses otherwise the water and containers are stolen. The water is stored under the bed. This is done by raising the bed so that there is enough space to put the containers. This makes the house perpetually damp and people suffer from pneumonia all the time. Even though the bed is stable, it is quite high to climb to sit or to sleep at night.
6.Who is in charge of water services in this settlement?	It is the cartels and if you complain that "this water is smelling like sewer' you are told" so what do you want? Go and look for water elsewhere then". We live in fear of the cartels here. In fact we have ablution blocks for example here in Zone 48 that are not operational because of lack of water.
7.Have you ever thought of moving to another settlement because of water?	I cannot move to another settlement because of closeness to my workplace, life is affordable, education of the children is cheap. Even if there is no water at least life is affordable and that is why I would not move. The fact that I cannot move does not mean that I like living here.
8.Do you feel that you have a voice in the settlement?	They feel that they have no voice. The politicians come to listen to us during campaigns when he wants our votes.
9.Do you disagree over water in the house?	There are quarrels in the house especially when my husband has not left money for buying water and he still wants to shower with enough water. It is impossible because he is not the only person who needs

	water in the house. I think that when water is not enough we should take a 'passport' shower. A passport shower means you only wash your face and brush your teeth.
10. Where else do people get water from?	I have heard that some people have wells in their houses, and they use the water for cleaning the toilets. This is usually a guarded secret since if people know they will keep disturbing them asking for water. There is a quarry that has water accumulated that is sometimes pumped and sold. But all this water is very unhygienic.
11.Do you have meetings in the settlement to discuss water?	There are community meetings in which water issues that we are facing are discussed.

APPENDIX 3c: Excerpts from an Interview with a Water Vendor

Interview date: 01-09-2018

Location of interview: Mukuru, Zone 48

Time of start of interview: 2.40pm

BIO DATA

1. Gender Male (x) Female ( )
2. Owner or employee ----------Owner----------
3. How many years have you worked as a water vendor in this area? ---12----------
4. Do you sell water in other settlements? Yes ( ) No (x)
5. Do you live in this area? If no, where do you live? Yes

Question	Response and observation
1.How would you describe the water situation in this area?	I have been in the business for 10 years now but I should stop the business. It is not a business that one can depend on to take children to school or make major investments. The water situation has grown worse as it is controlled by few and use by many. The water is blocked by the cartels. The main pipe is 3 km away an unless you have financial muscle it is impossible to access water. There is no water but the bill from NWSC arrives punctually. The cartel is a family business. At the end of the month the directors of the company have a tip. The cartel is a ring. No one can access water expect through them. They demand that chambers

	should be put in the settlement but when they are put they say that they do not have sufficient pressure.
2.What is the process of applying for a water connection?	Fill in the form from the water utility. Then you need a PIN certificate, authorization from the chief duly stamped, minutes of the meeting where the members deliberated the application for a meter if you are an organization, Kshs. 2,500 survey fees and Kshs. 5,000 for the meter deposit. Then water company connects you to the main pipe after some time could be upto 6 months. For individuals: id copy, passport photo, letter form the chief, Kshs. 2500 survey fee and Kshs. 2500 meter deposit. Many times you go through the process and then you are asked to apply again because the file is missing. It can sometimes take 3 years to get a connection and then ask you to pay again. With the cartels: pay Kshs.40000 to have a meeting with them, then you buy the pipes and pay for the labour to dig the trenches, the total cost of the investment varies depending on the distance to a reliable water point.
3.What challenges do you face in the water business?	My water was disconnected a while back and the company was asking for Kshs. 5,000 for reconnection. This money is paid to the chairman who then takes it to the company. Cartels are known. If you need water you approach them and negotiate the price that you would like to pay for the water. If you try to sell water at a price lower the tank is bust. When that cartels discover that you have many customers then they cut the supply. They pump water when there is rain. If you breach the rules the chief comes for you and you are jailed for 2 days. August/sept are day months and the cost can go up to 40 Kshs. When the demand is high the cartel cuts the water and put a water point near your water point so that they can control the whole area. Intimidation rules the area. Population increase and the dominance of the cartels. The governor is under siege. Cartels are beyond repair and the situation will never get better.

4.What do you do in times when the water is insufficient?	Desperate measure is to get water from them. The pricing is done such a way that you cannot sell as it will be loss making.
5.Do you use a cash based or credit system? How do you ensure that your customers pay you?	Mostly cash based but credit is also available Credit sales are permitted and you pay when you get money. They provide credit services: we have a human face so we understand. If someone does not have money today, they will have tomorrow. The credit period varies but you have to remember that people move in and out of the village fast and they might leave with your money.
6.How do you determine your prices? Maximum prices charged? Do you agree with other vendors about the price to be charged?	The cartels keep increasing the price of water saying that the cost of pumping water is high. In some places prices are Kshs. 5 or 10 while here it is Kshs. 20 which is unfair because this is in same settlement. The differential pricing is because the price depends on the topography, the distance between the village and the chamber because of connecting pipes and pumps. The cost of running the pump increases the price of water because you cannot sell if the pressure is low
7.How do you distribute the water? People or hand cart?	People come to the tap to buy water. The cartel leaders issue orders and give direction on water related issues such as where the vendors are supposed to distribute water. So each member only operates in his area of jurisdiction. Hand carts are for the powerful people. The cartels have about 1000 young hand cart pushers who distribute water in the settlement. Hand cart pushers get the free water and sell it right in front of the police post. They are employed by the cartels.
8.How do you determine which customers will have preference in getting water? Prompt about the queueing system, who get supplied first and why.	First come first serve basis. They also agree on the queue who should get priority e.g. the age, health, mother with child etc. There are 2 types of queues for water in the settlement; the express queue which has no waiting time and the regular queue. If a resident opts for the express queue the price is between Kshs. 30 or 50 per gallon while the price for those who prefer the regular queue is Kshs.5. You see, younger men dislike queueing since it is mostly women on the queue. In other instances, a resident may be in a hurry to go to work or attend an emergency in the

	house. Although the queue operated on a first-come-first-served basis, rowdy residents and those who could push and shove jumped the queue.
9.Are there collaborations or partnerships for instance among water vendors? Do you share information with other water vendors?	There are no collaborations. The challenges are the same. Some of those who attend the meetings come to spy for the cartels and therefore meetings become useless. The association of water vendors is also a merry go round. To sustain attention table banking is done. The cartels make monthly contributions to a common fund to pay state officials' monthly stipend while serving as a rotating savings and credit association (ROSCA) - an informal investment bank where members can borrow money to expand their business or for personal projects. This makes them even stronger.
10.How do you resolve conflicts with other water vendors? With customers and state officials?	The conflict is usually between those who leave their containers and they get back and discover that they have been jumped in the queue. The conflicts among water vendors are over meters.
11.How do you relate with the county officials?	Meeting with water vendors association. The chairman is the person in charge of the chamber. The meeting discusses the people with illegal connections and also collect money to get attention from the water company if they have complaints. There is a satellite office in Mukuru but it is a toothless bulldog.

APPENDIX 4: KEY INFORMANT INTERVIEWS

Background	Given their position and knowledge about the provision of water services to informal settlements in Nairobi and Johannesburg, nineteen and twenty-one key informants respectively were selected through snow balling using the following criteria: • The ability to provide deep insights on the situation of water provision in the settlements. • The capacity to communicate their view impartially.

Objectives	The objectives of using key informants are as follows: • Give objective information about the provision of water services to informal settlements. • Gain a better understanding of the status quo of the water services situation in the informal settlements.

APPENDIX 4a: Excerpts of a key informant interview with JW official

Question	Response and description
1.If informal settlements are illegal in the sense that many of the times, they occupy land that is private or contested land how is it that you continue to provide water for them?	You see the thing is, strictly speaking, it is a legal requirement in South Africa. Everybody must be provided with water and sanitation so when it is an informal settlement situated on government land that is earmarked for future development, housing development anyway then we provide basic services. You are familiar with the difference between rudimentary and basic services in our context? Basic services entail a standpipe with the 200m radius, and your sanitation is usually a VIP toilet or these communal flush toilets that they have recently started to install. So, then we provide the basic service but when it is an informal settlement situated on private land or illegal then we provide rudimentary services which is basically water supplied to a tanker truck and tanks as well as your sanitation is provided from a chemical toilet in a communal fashion. It is not seen as a basic service but it is basically seen as a rudimentary service or we call that as a nominal services for a lack of the better word but the reason why you do provide is because the Act says it does not matter where the people stay everybody is entitled to water and sanitation so it is a part of our Constitution. You have got a right to a sanitation of a certain standard and you have got a right to clean drinking water. We are trying although it will not be recognised, when they look at coverage, but at least to provide something in that area.
2.What are the functions of the operations of the operations department?	Like when NSD provides to install the standpipes and the VIP toilet infrastructure, we are responsible for the maintenance thereof. When it is regarding standpipes, it is about the maintenance of the standpipes when it is leaking to make sure that it does not leak. When it is vandalised, we try to replace it and so forth and then in [inaudible] is to actually go and disludge them. That is to remove the excrement in the pit. So that is our involvement but then further to that like then we have got nominal services which is your chemical toilets and your water tank, we in our department we call it onsite services where we appoint service providers, where we hire the chemical toilets [inaudible] and they clean it for us and we manage them. The same thing with water tank where we have- we are renting several mobile water tankers and that go around and fills up the

	stationary water tanks. So that is our responsibility from our operational point of view.
3. How do you ensure that the standpipes are producing water?	That is a given. So, the standpipes must produce water because it is connected to our normal reticulation. You know, when they install them, they connect them to-- although it is a standpipe reticulation within the informal settlement, but it is connected to the formal reticulation of the network.
4. What your assessment of JW performance in the last few years?	The thing is the problem is it is an informal environment. It is not a stagnant environment so I can have an informal settlement today let us say consisting of 100 households. Best scenario, it will be situated on-- okay, it is starting today because we have got a set plan rolling out basic services to provide basic services this financial year. It might be the next financial year as budget comes so I will provide chemical toilets but the water tanking. But remember that a chemical toilet is a communal facility that you provide and then water tanking is not necessarily in the 200m radius today. Within a month, the settlement starts growing because there is prospective of some services that is coming so you are always behind. So although you tried from a chemical toilet point of view, one chemical that is for seven households, you know it might be in place today but let me promise you in one month time it will no longer be the case so therefore then you are already on the backfoot and your service is already not sufficient in that regard. The same thing happened with your basic services and that is sometimes even worse because you find in some of our settlements you have got basic services and then you have got rudimentary services right around the settlement and it is because people saw there is an opportunity of better things to come - and you cannot blame them - better things to come because so therefore let us start increasing the things so you are always on the backfoot. I think what we have and what we are dealing with, I am of the opinion we do very well but whether we are servicing according to our standards, not always, because of the growing demand. And then as well the other thing is unfortunately - I do not know whether it is a Joburg thing, or is it a South Africa thing, or is it an Africa thing - people always want better so today I will give you a chemical toilet. I am not happy with the chemical toilets so therefore I will not look after it. Of the opinion that this is all that I currently have so if I do not look after it, I am back to square one where I have nothing. I say we find it very difficult for people to give responsibility or accountability for what they currently have. I do not say that they must just accept that is all they can have because if you talk to the people from housing or Housing Masterplan and eventually that is the plan that everyone will be provided with housing if they are entitled to one. But that is currently, if I ask you, it is still a battle that we are fighting, to get the community-- yes, in certain communities you do get people taking responsibility and it is usually your older communities.
5. How do you coordinate the repairs and the maintenance.	We are busy changing that philosophy now but originally how it works is people can report, either through-- okay in the informal environment it is difficult because you know everybody has got cell phones but now to use the call centre

	and so forth is not always that easy. But within the informal settlement remember that they have got ward councillor and ward councillors has got community representatives that is working for the water council that is representing smaller groups. So those are where the people can report, to the water council. The water council will inform Joburg Water that there is a standpipe that needs maintenance with chemical toilet or a VIP that needs desludging. That is the one thing. The other thing is as we do these services, we have got the onsite inspectors and besides looking at the service provider that he does according to the contract I have got with him, they are also noting to say, "Listen here, I have got chemical toilets right now but there is the standpipe leaking, standpipe number 123," so they lock it through that process. But then the third one that we have started a couple of months ago where we, because we have got so many informal settlements, so we are proactively going through those informal settlements and checking and we are not actually sending the onsite information coordinator who is supposed to look after the contract. We actually send a guy who can fix, so he has been going. There are 10 standpipes in that settlement so I will go to every standpipe. Whether it is not leaking, standpipe number one is not, standpipe number two is leaking, I fix standpipe number two, number three is a problem. We started that thing more on a rotational basis because it is difficult for people to report. When they do report to the community and the ward council structures it can take some time, because you know sometimes it can take up to a week, if not longer, because unfortunately some of the councillors wait until they see an [inaudible] for a meeting or when there is a community meeting they list all of these issues you now and then you find that it is already a month or two old. But at least something goes through and then, so like I said, it is not-- so those two things, it is not really effective. It is more of our internal. While they are doing one thing they check the other but then now they specifically go to the informal settlements and then check the pipes.
6. What do you mean by political sensitivities and have you had experiences?	Political sensitivity when people start resisting. Like you say, I am removing all the illegal-- like what happened last week in Soweto where they removed illegal electricity connections where they started burning the municipal buses because of that. So that is why I said it becomes-- they make it now political. It becomes and issue where you are taking away this illegal service and therefore now I am going to take it out on the clinics, on the schools, or on the public transport so then that is why I would rather, in that instance-- maybe this is not a good example but that is unfortunately what happens in these environments. So, when you start with [inaudible], especially in the informal environment, I think they've almost got nothing, or they've probably got nothing. The little that they've got, they say but now you are also taking it away so therefore it creates that resistance and unnecessary-- you know, if it was only resistance and the thing that everybody is *toyi toying* there in that settlement, but it usually spreads over. In fact, in Kya Sands, I think they sometimes spread over to the factories across the road, where factories have been put in danger and you say I think what you are doing now is putting my business at risk or these people's livelihoods that at risk. You must be very sensitive when you look at those things.

7.Are there efforts to integrate service delivery in the city?	But it is all over. It is not only in an informal environment. In a formal environment you get the same thing because one of the other things that I am struggling with in the informal environment is the incorrect use of sewer infrastructure when people want to dispose of their solid waste through the sewage system that can cause blockage and all those things and [inaudible] relations between solid waste services and [inaudible] of taking away solid waste on a frequent basis. If you do that, I will not have a problem on the sewer system, but if you do not do that people try to dispose of it through the sewer system just to get rid of it but then you have got all of these other problems that you sit with.

APPENDIX 4b: Excerpts of a Key Informant Interview with NWSC official

Question	**Responses and description**
1.Please briefly describe the evolution of water services in informal settlements.	After post there was a realization that one of the factors that contributed to hostility was water because ethnicity governs water in the IS. PEV: water increased the tension. By cutting the supply of water for the other ethnic groups thus managing to weaken them. During elections the ethnicity becomes more pronounced. The tension is even more when people live in close proximity. Legislation that was pro-poor implementation of plans, strategies but the min of water addressing provision of services to IS. Key people and departments concentrating on IS. IS department in 2008 with the primary objective of providing water and sewer services that had been neglected for a long time. The model is to lay networks and look at the most appropriate communal method to reach the communities. Limitation of space made this a viable option. It was upgraded to a region in 2015 because previously it was part of other regions and they would mostly concentrate on the formal because the regions generated revenue and the IS tended to be problematic. As a department they were concerned with putting up the infrastructure and handing it over to the other regions. The organization of IS into a region makes it a one stop shop: infrastructure, customer relations, operating using one business process and not several making the approach focused.
	Chambers are located in the periphery where there is a road to maintain control over it, monitor and have access to read the meters. It also makes is difficult for them to tap water along the way before it reaches the chamber. PPD is a way of leveraging technology to make water affordable and accessible. Connection to structure if persuaded that the company can have access to read the meter and that the owner has the appropriate documents. “Chamber politics” water is a political tool. It is a weapon used to reward or punish.

	Implementation has many stakeholders such as ward admin, youth, elders Every election cycle changes priorities and each new entrant would like to start afresh and change a number of the existing things. Ethnic tensions in the IS are primarily around water. Conflict around the chamber tends to peak when there is political tension.
2.What are some of the challenges that you face?	Kisii water company: why the Kisii? They are innovative, the have formed a strong cartel that is able to sabotage the process. They have sophisticated pumping systems for siphoning water. They are well connected. Water business is highly profitable because water is free and they can go to any lengths to protect their business. They are well connected to the admin and the political circles. The businesses could also be decoys and sometimes it is hard to know the real /proper cartels. Risky and difficult to control the cartels. During a community meeting on the water situation in Mukuru there was an embarrassing situation for the company officials. In this meeting, the senior cartel member named all the administrative and company officials (present and absent) who had received bribes as well as the amount of money given each of them. He asked the officials present to counter the accusations but none of them responded and so the meeting ended abruptly. You see, the cartels really dominate the officials. Enforcement under the CG not the NWSC for example ensuring that all the people getting water pay for it, ensure that everyone is metered is paying for the consumption. Land tenure, structure owners hand over the meter to someone else or to a different entity that the water company does not know. It is difficult to get this person to pay the bill. The process of enforcing is tedious and the company may not follow the legal process. Vandalism: the metal cover over the concrete chamber is sometimes stolen for sale thus exposing the meters and the meters being used to damp rubbish making it impossible to access and also flooding. They have a number of survival tactics. The cartels do not like to be tagged as cartels but as alternative service providers. they sprouted because there were service gaps and they established the businesses as a means of livelihood. The Kisii are very enterprising and they identified a service gap before others and entrenched themselves and invited their kin to do business. The cartels are also linked across the other informal settlements. The Kisii water company. They are too powerful and are well connected. They have the economic muscle and can lay pipes up to 2 km. they invest a lot. Their vending points have a lot of pressure because they have pumps and therefore residents prefer to buy water from them rather than queue at a service point that has low pressure. They also have constant supply of water. They have a networked supply such that they tap from various pipes that have water on different days of the week hence they have water on all days of the week unlike other water vendors.

	Another challenge is the fact that CGN expects that we supply water to the residents efficiently at an affordable cost but in such dire situations you either focus on increasing accessibility or profitability but not both. Already the high levels of NRW in Mukuru are caused by non-payment by residents due to high levels of unemployment and low wages.
3.Engagement with the community	Task team with 10 to 15 members key stakeholders from politics, FBO, CBO, county and national governments, women etc. Explain what the company wants to do, get their views, and use them as change champions. There are also involved in the implementation process to give feedback. If a change is to be effected, it is important to think about the impact of the change. Talk to those who are siphoning so that they apply for a meter. Do not stop them from selling, instead bring them to the system. Make them legal.
4.Please elaborate on the strategies that have been implemented to improve the situation	Approaches: the community approach. Integrating into the community and being embedded so as to be to discuss issues not as strangers but as partners. Sociology department is the link between the community and the other departments. Even with hostility there are ways of gaining entry into the community. Barazas are sometimes organized for all.
5.What difficulties do you face improving the situation of water services?	IS water provision is difficult because of attitude. The soft power approach is needed to change mind sets by engaging people from the start the attitude is the sense of entitlement that makes them feel that they deserve free water. The services cannot be free because there is a cost. Fatalistic attitude: anyone who tries to change is an enemy. They are used to the situation. The cartels are not happy about the change. “I have lived like this all my life why do you want to interfere”. Most of the water tracks pass through the settlement rendering them susceptible to being punctured.
6.How do you deal with non-paying residents?	If the meter bills are high then they agree on an instalment plan. The residents cannot be intimidated as they are used to violence, you cannot use force because they are more forceful than you, Disconnection is the last resort. Main stakeholders are the structure owners. They also have meetings for water vendors only.

APPENDIX 5: EXCERPTS FROM THE FIELD DIARY

14th November 2018

After the interview, Respondent X offered to take us around the settlement as he had a good understanding of the evolution and location of all water points by virtue of living in the settlement since 1995. This changed the initial plan of being taken around by the guide. Further into the conversation we asked him if he knew any of the pioneers of the settlement. He referred us to Respondent Y, the first female settler of Kya Sands and gave us her cellphone number so that we could book an interview.

Busi and I decided to call to check on her willingness and availability for an interview. Busi made the phone call and when she picked up the call she was unwilling to engage us in a conversation. However, Busi proceeded to tell her that from the interviews we had conducted it seemed that she played a big role in the settlement and the people were quite grateful to her. On hearing this, she totally won over and asked if we could go for the interview immediately. Respondent X was kind enough to walk us to her house located in a different part of the settlement.

We got to her house which is made of brick and bigger than the rest of the houses we had previously seen. We found her seated on an arm chair with two young men seated on low stools and seemed to be issuing instructions to them. She motioned to us to wait. As we waited, my assistant whispered to me that she might a *Sangoma* (traditional healer) and she was in the middle of a ritual. Respondent X later confirmed his suspicion.

When she was ready to see us, she joined us at the foyer of her house. There was loud music coming from a restaurant near her house which she ordered the music to be turned off because she needed to hear and to be heard. The interview began. The interview was constantly interrupted by phone calls from people who according to her were seeking her services and help in various matters. She spoke with power and authority. I then realized that she had multiple sources of power: religious, economic and community leadership.

15th November

Today, after trying to get community leader V for the interview and he wouldn't pick up the phone. This was the nth time he wasn't answering the phone where n is large!! Feeling frustrated Busi and I decided to try another avenue since it was looking impossible to get him to commit to an interview. We asked the people at the Vukusenzele community center to give us the contact of another community leader who also happened to be Chairman of the settlement committee. Busi called him and he gave us an appointment the following day at the community Centre. I was surprised at how easily it happened considering that we had been trying to get community leader V for a long time.

16th November

The chairman arrived punctually to the Centre. The interview went well and at the end we asked him if he knew where the water points in the settlement were located and he answered in the affirmative. He asked if we wanted to see them and we told that we were very interested. He offered to take us around the settlement. Initially the guide was going to take the lead in the transect but we had to change this plan. I explained it to the guide and he had no problem with coming to the walk along with other residents.

10th November

We had the interview with the community leader Z in the afternoon. This was the fifth attempt of trying to have the interview. We were keen on having the interview as we had been informed that he was the person who sometimes engaged JW when there were water problems. When we called him in the morning to confirm the appointment, he said that he was still available for the afternoon meeting. We arrived at the community Centre for the interview, but he was nowhere in sight. After half an hour of waiting, we called him, and he said that he was engaged and that we should stop calling him and instead we should: " go to the internet, google Kya sands and you will find all the information about water there" and he hang up. It was quite frustrating, and we wondered why he had committed to the interview if he wasn't willing to do it in the first place.

20th November

We passed outside Community leader Z's house during the walk. He was outside doing some repairs. He recognized us but he did not make any sign to acknowledge us. He was clearly embarrassed about how he had handled the situation a week ago or maybe he wondered how we had managed to get the Chairman of the community committee to take us around the settlement.

The pleasant weather made the walk through the settlement bearable (we are in summer). Having the chairman as the lead of the transect walk was indeed a good decision because we are were able to see the behavior of the residents who were transgressing the rules when they saw him and how he issued the warnings to them. In addition, he knew which taps that were fixed in the three different phases of installation which made information quite detailed. The chair would point out to me details he thought were significant to understanding the water governance in the settlement. He also narrated the story of the different phases of the water point installation and how things have evolved around a water point since its installation. The other residents added details that he may have left out and corroborated the stories. The walk took five hours and by that time we were all so tired. We shared some snacks with the residents and then headed home.

APPENDIX 6: PHOTOGRAPHS FROM THE TRANSECT WALKS

a) Abandoned Infrastructure

Photograph	Location	Description
	Zone 48, Mukuru	A water kiosk owned by a CBO that was built with funding from an NGO in 2010. After a few months the kiosk closed due to lack of water. The CBO members sold the water tanks and distributed the money among the members.
	Moto Moto village, Mukuru	An FGD with residents seated on an abandoned chamber which is used for recreation as well as to dry cereals. This chamber is one of the oldest chambers in the settlement but with the expansion of the settlement, it became increasingly difficult for the NWSC to access the chamber to take the meter readings.

	Section D, Kya Sands	A disused water stand that was closed by JW due to flooding caused by taps that the residents left running. The residents living around this water stand walk to other water stands in the settlement.

b) Infrastructure breakdown

	Kya Sands section B	An illegal connection from a standpipe to a nearby tavern. JW officials were not aware where the illegal connections direct the water. The residents interested in a connection discuss the matter with the settlement committee to establish the water stand from which water will be diverted.
	Kya Sands Section A	A submerged water stand that is still producing water. The residents complained that despite reporting the leaking pipe to JW, no action had been taken to correct the issue. Moreover, there is an illegal connection from the water stand. The residents were particularly concerned about the stagnant pool of water that was a breeding ground for vectors such as mosquitos.

c) Wastewater disposal

Photograph	Location	Description
	Section A, Kya Sands	A trench that drains wastewater into the Jukskei River which pass through the settlement. Most of the trenches in the settlement empty into this river.
	Section D, Kya Sands	Gunny bags and old carpets that are used to absorb wastewater as well as storm water. The bags keep the walkways from being muddy and slippery.
	Section D, Kya Sands	Overflow of waste water on the road making it impassable. This waste water flows into the Jukskei River.

	Section C, Kya Sands	An open drain in front of the entrance of houses. The foul stench from the wastewater gets worse in winter since the solid waste is not washed away by rainwater. Thus, the foul smell is a permanent feature in the settlement.
	Vietnam village, Mukuru	A piece of the overland (on the surface) pipe dumped at a solid waste disposal site.
	Sisal Village, Mukuru	The photograph shows two drainage pipes emptying into the Ngong River which crosses through the settlement.

	Zone 48, Mukuru	The main waste water trench into which smaller drains empty.
	-do-	Waste water drain outside Embakasi girls' high school. Note that vegetable vendors are selling their goods beside the drain

d) Practices around the tap (bringing work to the tap)

	Kya Sands, Section B	A resident washing a mat at a water point. This is a forbidden practice since the water overflows onto the road as well as preventing other residents from accessing water.

	Section B, Kya Sands	Two female residents doing their laundry at the tap (to avoid ferrying water back and forth from the tap) which is forbidden due to the inconveniences caused to other residents.

e) Environment around the tap

	Section D, Kya Sands	Solid waste disposed of at the standpipe
	Section C, Kya Sands	-do-

	Section E, Kya Sands	An illegal connection
	Section A, Kya Sands	An 'all taps closed' standpipe
	MCC village, Mukuru	Pumps and pipes connected from the chamber into the settlement

APPENDIX 7a: Summary of showing the count of standpipes in Kya Sands

Section	Total Standpipes counted	Taps Functional (F) Non-functional (NF) Illegal connections (IC)	Observations
A	8	28 (F) 19(NF)	The ambience around the tap is clean The chairman of the committee lives in this area. There is a chicken slaughterhouse that has a dedicated water supply
B	6	21(F) 1 leaking 9(NF)	Some standpipes have been removed because the run of would get to people's houses. Topography characterized by gentle.
C	13	42(F) 27(NF) 3 (IC)	First phase of installation. Connection to car wash and urban agriculture.
D	6	15(F) of which 5 are leaking 12(NF) 3 (IC)	Referred to as the "failed section" Poor drainage and a lot of run off Illegal connections for urban agriculture and a tavern Most of the taps are not working and the effort of JW to repair them has proved futile.
E	5	24(F) 6(NF)	Newest installation most taps function. The taps are close to the road and the runoff is on the road.

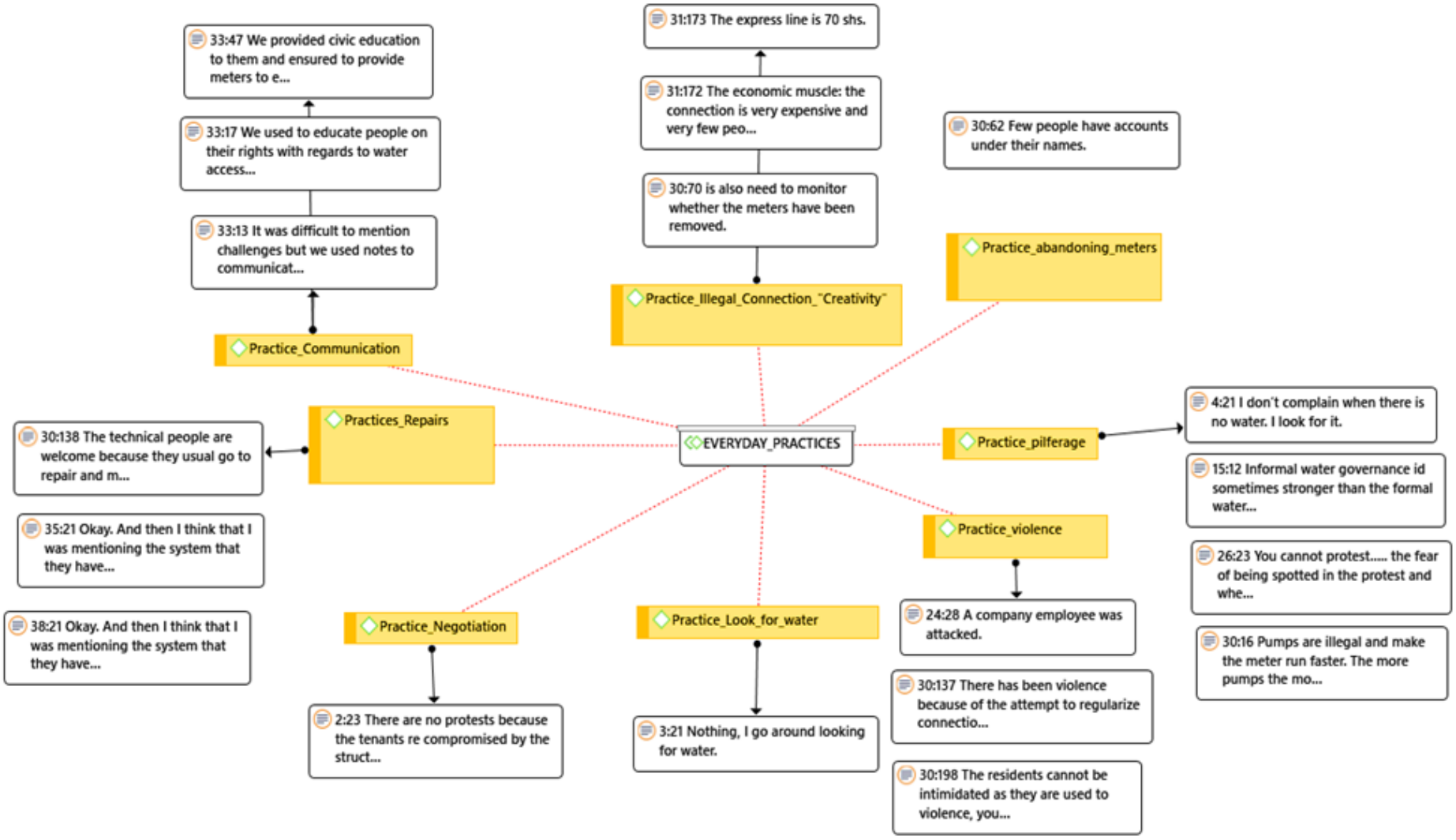
APPENDIX 7b: Transect Walk Checklist

Parameters	**Description**
The water stand location coordinates	
Functional taps	
Non-functional taps	
Illegal connections How many? Where they lead to?	
Environment around the tap Drainage Garbage	
Leaking taps Measures for leaking taps Wood Polyethene bags	

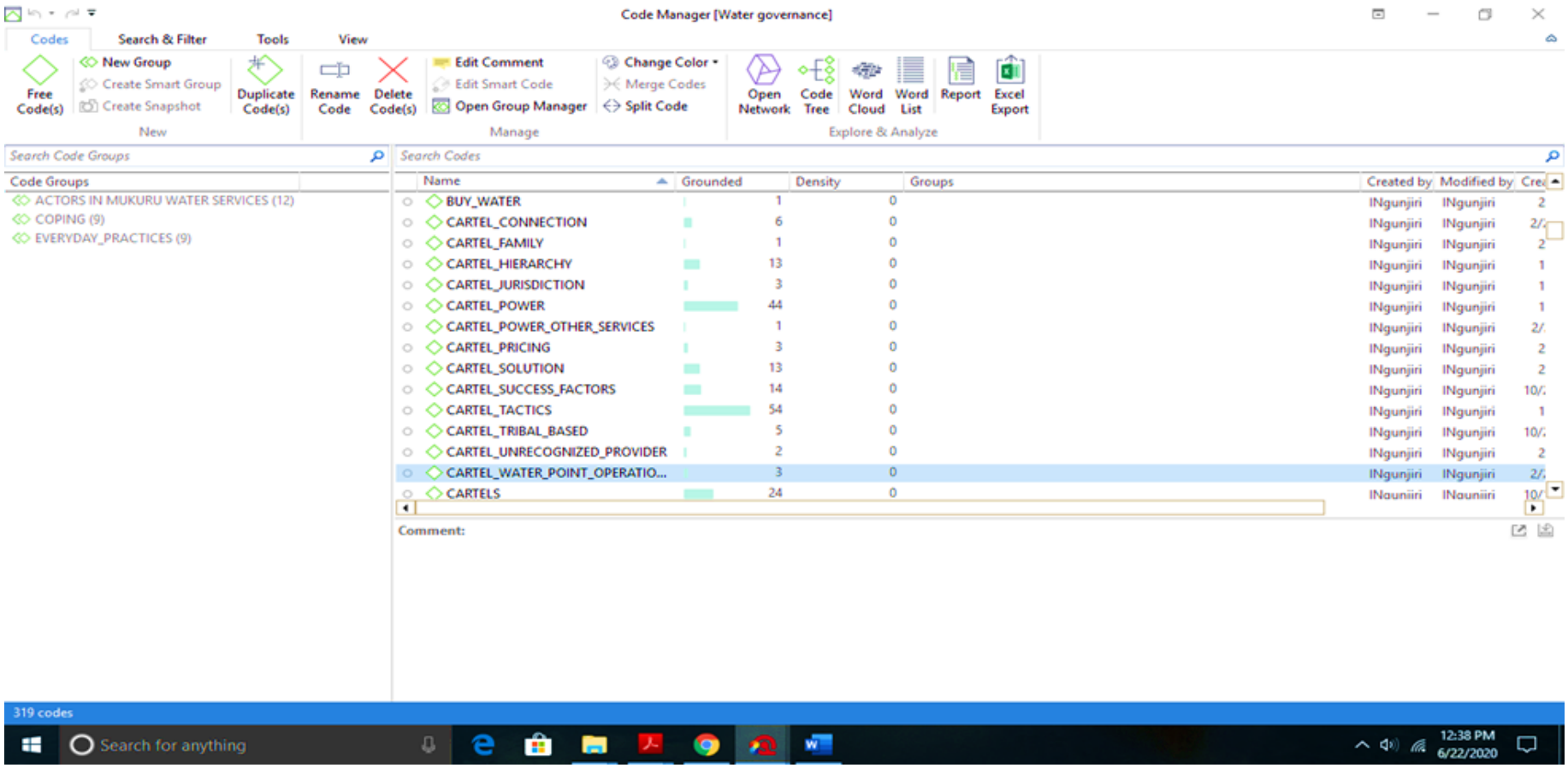
APPENDIX 8: Sections of the South African Constitution addressing access to water services

Section	Contents	Interpretation
27 (1b)	Everyone has the right to have access to— sufficient food and water;	Enshrines the universal right to water access.
9	Equality includes the full and equal enjoyment of all rights and freedoms. To promote the achievement of equality, legislative and other measures designed to protect or advance persons, or categories of persons, disadvantaged by unfair discrimination may be taken.	A call for affirmative action to redress past inequalities which prohibit discrimination in service provision.
10	Everyone has inherent dignity and the right to have their dignity respected and protected.	Water is needed to safeguard human dignity.
33	Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons.	Right to just administrative action which includes reasonable notice and participation in decisions that affect other rights including water disconnection.
7 (2)	The state must respect, protect, promote and fulfil the rights in the Bill of Rights.	Duties of the state to "respect, protect, promote and fulfill" the universal right to water access and to ensure that this right is gradually realized.
153(a)	A municipality must— Structure and manage its administration and budgeting and planning processes to give priority to the basic needs of the community, and to promote the social and economic development of the community.	Assigns the delivery of water and sanitation services to municipal authorities. Local authorities are charged with the provision of water services to communities.
24	Everyone has the right— (a) to an environment that is not harmful to their health or wellbeing; and	Healthy environment that protects people from harm for example proper disposal of wastewater to safeguard against disease.

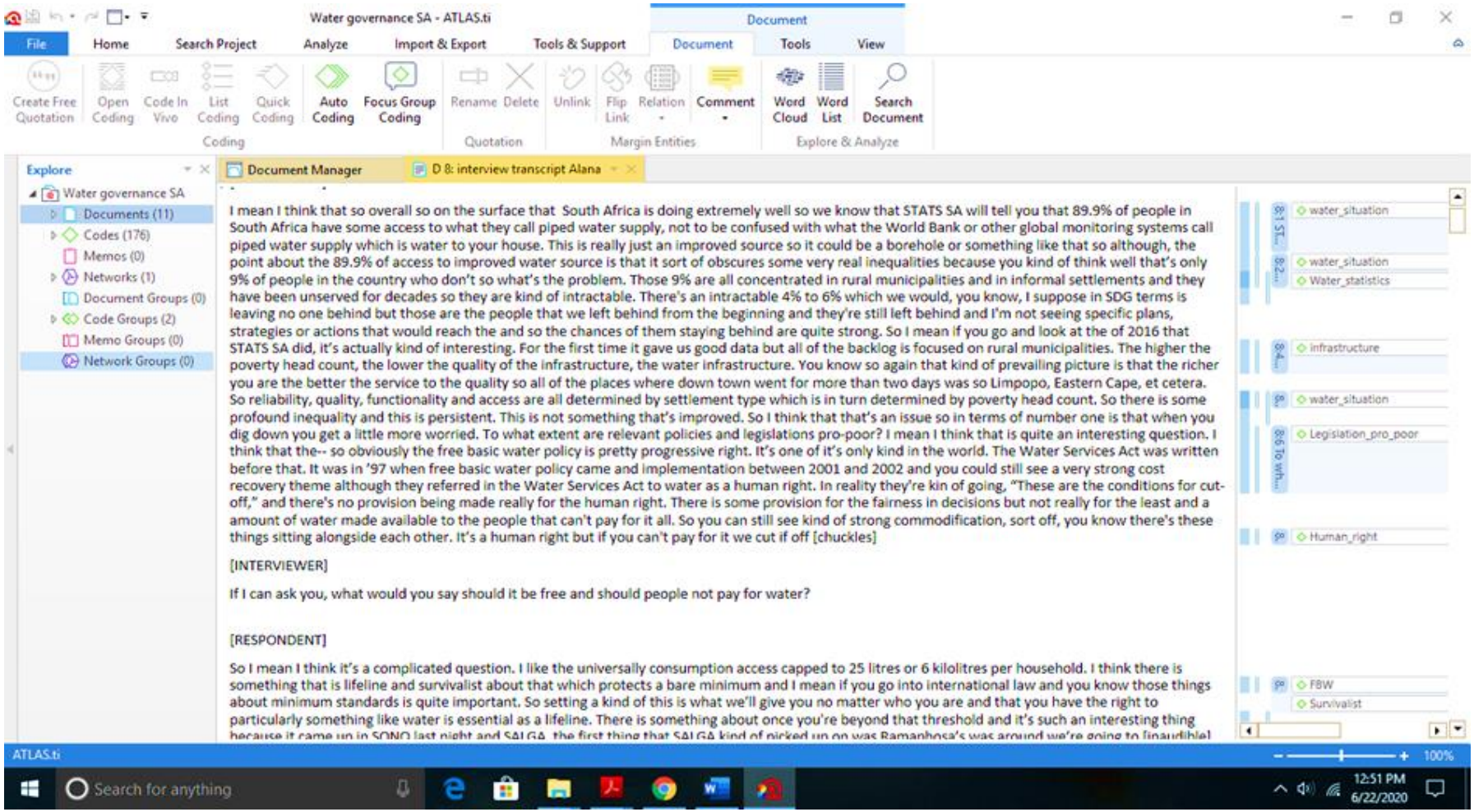
APPENDIX 9a: Detailed Atlas ti Mapping of Everyday Practices



APPENDIX 9b: A Screen Shot of Coding on Atlas ti



APPENDIX 9c: Working on the quotation level in Atlas ti



APPENDIX 10: The NACOSTI Research Authorization



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/81876/24576**

Date: **17th August, 2018**

Irene Wanjiru Ngunjiri
University of the Witwatersrand
SOUTH AFRICA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Water governance in urban informal settlements,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **17th August, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

National Commission for Science, Technology and Innovation is ISO9001: 2008 Certified

APPENDIX 11: University of the Witwatersrand Ethics Certificate

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Ngunjiri

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H18/06/26**
PROJECT TITLE	Water governance in urban informal settlements: The case of Nairobi and Johannesburg
INVESTIGATOR(S)	Ms I Ngunjiri
SCHOOL/DEPARTMENT	Architecture and Planning/
DATE CONSIDERED	22 June 2018
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	01 August 2021
DATE 02 August 2018	**CHAIRPERSON** (Professor J Knight)

cc: Supervisor : Prof I Irurah and Dr M Rubin

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ Signature

_____/_____/_____ Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES