



**EXPLORING THE EFFECTS OF WATER SHORTAGES ON CHILDREN'S
EDUCATION AND HEALTH WITHIN WARD 17 OF THE WATERWORKS INFORMAL
SETTLEMENT, GAUTENG PROVINCE, SOUTH AFRICA**



Mini dissertation submitted in partial fulfillment of the requirements for the
degree

Master of Philosophy in Integrated Water Management at The
Independent Institute of Education, IIE MSA.

PHUMUDZO D MOLOTO

Student number: [REDACTED]

Supervisor: Ms Linda Downsborough

Co-supervisor: Ms Vanessa Stippel

08 / 11 / 2024

ABSTRACT

Water is essential to all human beings. It is recognised as a human right that is protected by several international, regional and national human rights instruments. Water plays a significant role in keeping children healthy as their bodies develop. Access to safe, reliable water also helps children stay focused at school, allowing them to receive a quality education which means fewer sick days and good hygiene practices. Education is one of the most important factors that can break the cycle of poverty, especially in informal settlements and rural communities. Further, water, health and education are all critical themes within the United Nation's (UN) Sustainable Development Goals or SDGs. The SDGs are interconnected, meaning that one goal often supports or impacts the attainment of other goals. When there are water shortages, for example, then other goals such as health and education can be affected. Informal settlements, in particular, are vulnerable societies and are easily affected by water shortages.

This study explored the effects of water shortages on children's education and health at Waterworks, an informal settlement in Gauteng Province, South Africa. The objectives of this research were to investigate how water shortages affect children's health and education and how parents and educators deal with the challenges associated with water shortages. Considering the age, maturity, and developmental stage of the children as well as institutional ethical considerations, the required data was only collected from children's parents and school educators.

A qualitative research design was employed with a purposeful sampling method. Twenty-four participants were identified to take part in the study - 20 parents and 4 educators. A combination of semi-structured interviews and observations were used to collect data. The data was then analysed using coding and thematic data analysis.

The findings demonstrated that water shortages were an issue in the community of Waterworks informal settlement, often as a result of poor maintenance of water tanks,

insufficient and inconsistent water supply. Water shortages were found to affect children's health and education in several ways. Children's hygiene was affected at home by water shortages and often children suffered from illnesses related to water quality. Having to fetch water before school often resulted in children being late or missing school and girls often had to miss school during their menstruation further affecting their education. The findings also highlighted that those parents had to find alternative water supply, to address the water shortages. Some of the alternative water supplies included collecting water from Randwater leaking pipeline, buying water and storing water in big drums. Further, the study found that the schools have no alternative water supply, they only rely on municipal water supply. The Human Rights-Based Approach (HRBA) was used as a theoretical framework and noted that children were affected by all five cross cutting principles which include availability, affordability, acceptability, quality and accessibility. This effected both their health and education.

Whilst this is a qualitative study which cannot be generalized to all informal settlements, it highlights the difficulties that can be faced by children and recommends a number of approaches which aim to ultimately improve the lives of these children.

As part of this, the research recommends that local government could improve service delivery to the community by implementing a water delivery schedule, providing more water tanks, developing a maintenance schedule for servicing water tanks and improve sanitation facilities. The government should also accelerate the Reconstruction and Development Programme (RDP) so that children can have access to permanent running water in their households, which would improve their hygiene and reduce the number of schools missed. Parents could also form a water committee that would assist them to improve their water services, whilst schools should also look at other alternative water sources.

Keywords: water shortage, children's health and education, human rights, Waterworks informal settlement.

DECLARATION

I Phumudzo Deborah Moloto declare that:

- The research reported in this mini dissertation “Exploring the effects of water shortages on children’s education and health within Ward 17 of the Waterworks informal settlement, Gauteng Province, South Africa” is my own work. unless specifically acknowledged as being sourced from other researchers, then their statement has been re-written and been referenced. Where their exact words have been used, it has been placed inside quotation marks in italics and referenced.
- I further declare that I have not submitted this work for any qualification at any other higher education institution except IEMSA.

Student signature:



Date: 08 / 11/ 2024

ACKNOWLEDGEMENTS

I would like to thank the following people who have contributed to the successful completion of this mini dissertation:

- I would like to thank Almighty God for giving me the opportunity and strength to complete this thesis.
- I also would like to thank my supervisor Ms Linda Downsborough and my co-supervisor Ms Vanessa Stippel for their continued support, constructive advice, guidance, patience, and moral support.
- I would also like to thank the Randwater for providing me with financial support to obtain this qualification.
- Participants from Waterworks informal settlement, Zuurbekom primary school, and Protea Glen Secondary school that gave me their time and assisted me to complete my field work.
- I would also like to thank the community leader of Waterworks informal settlement for giving me the opportunity to do research in their community and taking me through the community.
- To my family, thank you for providing me with emotional support throughout my study. Your love and prayers have been greatly appreciated. Special thanks to my husband Antony Moloto for believing in me and my children Kgabo Moloto and Thendo Moloto, their questioning of when am I finishing school have encouraged me to work hard.
- My friend Promise Dlamini, thank you for her positive advice, encouragement and contribution to ensure that I complete this thesis.
- My classmates especially, Moletje Maponyane, for their academic support and encouragement.

DEDICATION

I would like to dedicate this mini dissertation to my husband Anthony Moloto and my children Kgabo and Thendo Moloto for their love and support throughout my studies and to my uncle, Doctor Rendani Malatjie who has been my role model since my childhood.

LIST OF ACRONYMS

GSG:	The Global Steering Group for Impact Investment
HAD:	Housing Development Agency (HAD)
HRBA:	Human Rights- Based Approach
IPEC:	International Programme on the Elimination of Child Labour
JMP:	Joint Monitoring Programme
MDGs:	Millennium Development Goals
RDP:	Reconstruction and Development Programme
RSA:	Republic of South Africa
SAHRC:	South African Human Rights Commission
SDC:	Swiss Agency for Development and Cooperation
SDGs:	Sustainable Development Goals
SSA:	Sub-Saharan Africa (SSA)
STATS SA:	Statistics South Africa
UDHR:	Universal Declaration of Human Rights
UN:	United Nations
UN-Habitat:	United Nations Human Settlements Programme
UNICEF:	United Nations Children's Fund
UNRISD:	United Nations Research Institute for Social Development
WHO:	World Health Organization
WWAP:	World Water Assessment Programme

Table of content

ABSTRACT	I
DECLARATION	III
ACKNOWLEDGEMENTS	IV
DEDICATION	V
LIST OF ACRONYMS	VI
LIST OF FIGURES	X
LIST OF TABLES	XI
CHAPTER 1: INTRODUCTION	1
1.1 Background of the study.....	1
1.2 Problem statement.....	4
1.3 Significance of the research.....	5
1.4 Purpose of the study	6
1.5 The research questions	6
1.6 Research objectives	6
1.7 Structure of the mini dissertation	6
1.8 Conclusion	7
CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK	8
2.1 Introduction	8
2.2 Key concepts	8
2.2.1 Water shortage.....	8
2.2.2 Access to sufficient water	9
2.2.3 Informal Settlements	10
2.2.4 Education	11
2.2.5 Health	12
2.3 Literature Review.....	13
2.4 Water as a human right.....	13
2.4.1 United Nation (UN) Charter.....	13

2.4.2 Universal Declaration of Human Right (UDHR).....	14
2.4.3 Sustainable Development Goals (SDGs)	14
2.5 Legislative Frameworks on access to water in South Africa	15
2.5.1 Constitution of the Republic of South Africa (Act No. 108 of 1996)	15
2.5.2 National Water Act (No. 36 of 1998).....	16
2.5.3 Water Services Act (No. 108 of 1997).....	16
2.5.4 Informal settlement in the international context.....	17
2.5.5 Informal settlements in South Africa	18
2.5.6 Water Shortages in informal settlements in the international context	18
2.6 Water shortages in the informal settlements of South Africa	21
2.7 Children living in informal settlements	22
2.7.1 Effects of water shortages on children’s education.....	23
2.7.2 Effects of water shortages on children’s health	25
2.8 Theoretical framework	27
2.8.1 Human Rights- Based Approach.....	27
2.9 Conclusion	33
CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY	35
3.1 Introduction.....	35
3.2 Research paradigm and approach.....	35
3.2.1 Target Population	37
3.3 Data collection, analysis, procedure and methods.....	37
3.3.1 Primary Data	38
3.3.2 Secondary data.....	40
3.3.3 Sampling procedure, sample size and selection of research participants	40
3.3.4 Data analysis	41
3.4 Data validity, reliability and trustworthiness.....	42
3.5 Limitations of the research.....	43
3.6 Ethical Considerations.....	44
3.6.1 Consent forms	45
3.6.2 Voluntary participation	45
3.6.3 Confidentiality and anonymity.....	45
3.6.4 Observations and photography	46
3.6.5 Data storage	46
3.7 Conclusion	47
CHAPTER FOUR: RESEARCH FINDINGS.....	48
4.1 Waterworks informal settlement background.....	48

4.2 Housing topology	51
4.3 Access to healthcare	52
4.4 Data presentation	53
4.4.1 Demographic characteristics of the participants	53
4.4.2 Employment status of participants	55
4.4.3 Educational background	56
4.4.4 Educator's profile.....	61
4.4.5 The extent of water supply in the community	61
4.4.6 Water shortages	67
4.4.7 Coping with water shortages	68
4.4.8 Safety	73
4.4.9 Effects of water shortages on children's education	74
4.4.10 Effects of water shortages on children's health.....	77
4.5 Conclusion	79
Chapter 5: Discussion of findings.....	81
5.1 Introduction.....	81
5.2 Water shortage.....	88
5.2.1 Availability.....	88
5.2.2 Accessibility	90
5.2.3 Affordability	90
5.2.4 Acceptability.....	91
5.2.5 Quality	92
5.2.6. Cross-Cutting Principles.....	92
5.2.7. Water Shortages at the Schools.....	92
5.3 Coping with water shortages	94
5.4 Safety.....	95
5.5 Effect of water shortages on children's education	95
5.6 Effect of water shortages on children's health.....	97
5.7 Conclusion	98
CHAPTER 6: CONCLUSION AND RECOMMENDATIONS.....	99
6.1 Introduction.....	99
6.2 Summary of the findings	99
6.3 Conclusions drawn from the research	102
REFERENCES	106
APPENDICES.....	113
Appendix 1 Interview questions for parents.....	113

Appendix 2 Interview questions for educators	117
Appendix 3 Observation schedule at community	122
Appendix 4 Observation schedule at school.....	123
Appendix 5 Consent form for participants.....	125
Appendix 6 Ethical clearance letter	127

LIST OF FIGURES

Figure 1: Water sources used by schools in Gauteng (SAHRC,2021)	4
Figure 2: Human Right-Base Approach cross- cutting principles to water rights	32
Figure 3: Location map of Waterworks (Rand West City Local Municipality, 2020).....	50
Figure 4: Map of Waterworks Informal Settlement (Google Earth Map, 2024).....	51
Figure 5: Houses layout (Researcher,2024).....	52
Figure 6: Gender Profile of Participants.....	54
Figure 7: Age range Profile of Children.....	55
Figure 8:Distance zone between schools and Waterworks Informal Settlement (Google map, 2024)	57
Figure 9: Zuurbekom Intermediate Primary School (Researcher, 2024).....	58
Figure 10a and 10b: Water tanks used for rain water harvesting (Researcher, 2024).....	59
Figure 11a and 11b: Low water pressure in taps and a dysfunctional toilet due to low pressure (Researcher, 2024).....	59
Figure 12: Bucket used to flush grade 1 toilets due to low pressure (Researcher, 2024)	60
Figure 13a and 13b: Protea Glen Secondary School (Researcher, 2024).....	61
Figure 14: JHB water filling water tank 1(Researcher, 2024).....	62
Figure 15: The location of water tanks and leaking pipeline (Google Earth Map)	64
Figure 16a and 16b: Tank 8 sitting on low position. Source: Researcher (2024) and Lifted tank 7. Source: Researcher (2024)	65
Figure 17a and 17b: Tank 7 with no top lid. Source: Researcher (2024) and Tank 3 (Stolen tank). Source: Researcher (2024)	66
Figure 18: Number of days without water.....	68
Figure 19a and 19b: Underground leaking pipeline Source: Researcher (2024).....	70
Figure 20a and 20b: Evidence that people do their laundry at the leaking pipeline. Source: Researcher (2024) and Pond with polluted water. Source. Researcher (2024).....	70
Figure 21: Water storage containers and transporting method (Researcher, 2024)	71
Figure 22a and 22b: Children transporting water home home (Researcher, 2024)	74
Figure 23: Communal sanitation facilities (Researcher, 2024)	79
Figure 24: Age range Profile of Children	82
Figure 25: Location of water tanks	86

LIST OF TABLES

Table 1: Employment Status of Parents.....	56
Table 2: Gender profile of educators	61
Table 3: HRBA cross-cutting principles of water rights.....	82

CHAPTER 1: INTRODUCTION

This chapter provides an introduction and background to the study, which aims to explore the effects of water shortages on children's education and health at Waterworks informal settlement. The chapter then expands on the research problem and the significance of the research before highlighting the overall purpose, research objectives and research questions. A breakdown of the chapters is provided to guide the reader through the mini dissertation.

1.1 Background of the study

Access to sufficient water is one of the primary human rights globally, which is protected by several international, regional and national human rights instruments. However, despite the signing of numerous international water treaties, there is often a lack of clear guidance on how countries should cooperatively manage water resources to prevent water-related conflicts (Guppy & Anderson, 2017). Water conflicts are already a concern in many countries often resulting in water shortages. Provision and access to water are also goals included within the Sustainable Development Goals' (SDG) and water shortages may contribute towards failure to achieve the water-related SDGs, in particular, SDG 6.

South Africa is a party to these SDG's as well as regional human rights treaties like the African Charter on Human and Peoples' Rights and forms part of other international communities such as the United Nations, which ensures that human rights are protected. To achieve some of the treaties/ goals mentioned above, South Africa has integrated key principles into its own legislation that follows the guidelines of the international and regional treaties. Section 27(1) of the Constitution, for example, states that "*every citizen has the right to sufficient water*". Furthermore, it also states that "*the government has to place equitable legislative and other measures, within its resources, to achieve the realization of this important right*" (Constitution, 1996).

Several studies have highlighted that not everyone in the world has access to adequate safe water for general use on a daily basis. In 2015, the World Health Organization (WHO) and the United Nations International Children's Emergency Fund's (UNICEF) Joint Monitoring Programme (JMP) estimated that 844 million people in the world lack access to clean water (WHO & UNICEF, 2017). A report by Zubaidi, et al., (2020) indicated that several regions in the world have been facing prolonged water shortage challenges. Some of the causes of these water shortages include climate change, increased demand for water due to population growth, poor management of freshwater resources, and misappropriation of funds by water utilities (Salehi, 2021). Water shortages are thought to be one of the greatest concerns in most developing countries, South Africa included.

The Gauteng Province is the smallest province in South Africa in terms of landmass but has the highest population (Department of Statistics, 2022). The province is mainly made up of urban areas, townships, and informal settlements. The province is well known for being the economic hub of South Africa, attracting migrants from other provinces looking for better economic opportunities (Zubaidi, et al., 2020). This exponentially growing population puts intense pressure on basic services such as water supply and housing. People are forced to live in informal settlements on the outskirts of urban areas and it is the residents of these informal settlements that are mostly affected by water shortages. However, the White Paper on Water Supply and Sanitation Policy of 1994 (Muzondi , 2014) does make provision for residents of informal settlements to obtain and have access to water.

The availability of water in informal settlements has a role to play in ensuring children's well-being, including health and education. A shortage of water supply has the potential to affect health negatively both directly and indirectly. It also has the potential to affect good sanitation and hygiene practices. (Hunter, et al., 2010). Health risks such as dehydration, child malnutrition, and waterborne diseases are linked to shortages of water and compromise the mental development of children. According to Save the Children (2006), a child dies every 15 seconds from lack of access to safe water, within informal urban settlements, in particular, showing high death rates as a result of limited access to sufficient safe water and poor sanitary conditions. Every 2 minutes a child dies from a water-borne disease around the world with 1 in 4 children

suffering from chronic and stunting malnutrition, which is related to lack of access to safe water and sanitation (WHO, et al., 2022). UNICEF believes that *“investing in children is the best way to develop a nation and ensure that future generations break out of the vicious cycle of poverty, violence, and disease”* (UNICEF, 2009 p: 02).

The South African Schools Act, Act 84 of 1996, states that learners have the right to access safe drinking water in a safe environment that is favourable to education. Further, to sustain progressive education at schools, a reliable water supply is needed. One of the major contributors to absenteeism from school in developing countries is sickness from water-related diseases. It is estimated that 443 million school days are lost annually globally due to diarrhoeal diseases (Save the Children, 2006). WHO also reported that almost 1.7 billion cases of childhood diarrhoeal disease are reported every year globally (WHO, 2024). In addition, schools rely on water for a number of activities, for example practicing good hygiene, for the provision of proper sanitation facilities, for drinking purposes, for cleaning, sports activities, the performance of educational experiments, agricultural production for food processing and for cooking, where schools depend on in-house vegetables for school feeding schemes. Therefore, quality education depends on the availability of water; and without a consistent water supply, it is challenging for schools to function properly. Water is therefore a critical requirement for children’s education.

A recent study conducted by the South African Human Rights Commission (SAHRC) reflects the conditions of water and sanitation availability in South African schools (SAHRC, 2021). The study found that 366 South African schools do not have an adequate water supply, affecting 5 429 teachers and 144 255 pupils (SAHRC, 2021). The study also highlights that schools most affected are those situated in rural, township, and informal areas. The study further revealed that 168 schools in Gauteng have water infrastructure challenges, of which 11 schools (6 percent) are serviced by borehole water, 30 schools (18 percent) are serviced by municipal connection and 127 schools (76 percent) are serviced by the use of water tanks. Figure 1 below shows a breakdown of the sources of water used by schools in Gauteng.

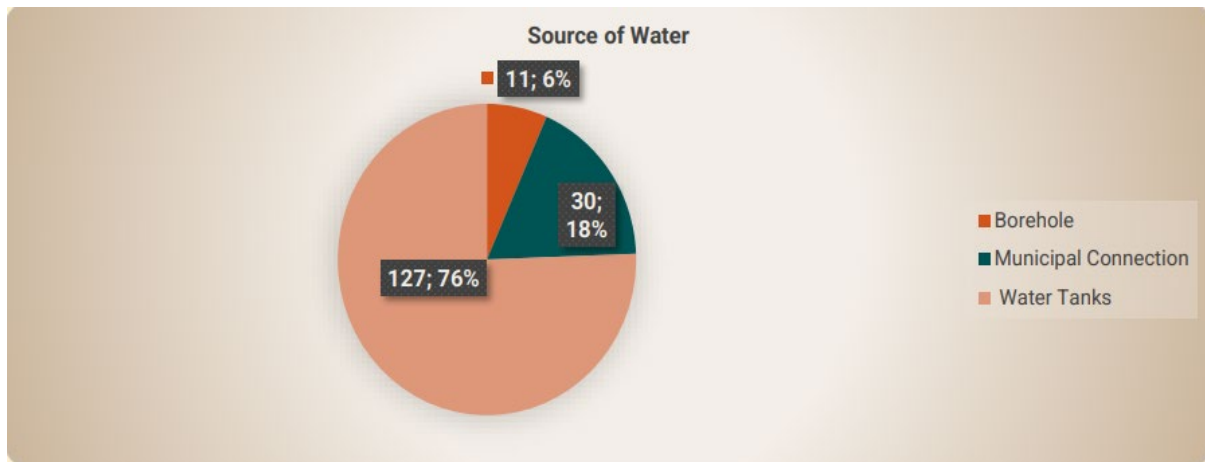


Figure 1: Water sources used by schools in Gauteng (SAHRC, 2021)

This research is aimed at exploring the effects of water shortages on children's health and education in a South African informal settlement. The investigation aims to highlight how parents and educators deal with the issues of water shortages and how these water shortages affect their children's education and well-being.

1.2 Problem statement

Access to sufficient reliable and clean water is a challenge within informal settlements in South Africa and may have a number of negative knock-on effects in particular, on health and education (Donnenfeld, et al., 2018). Previous studies suggest that a lack of access to water prevents good sanitation and hygiene practices and may result in health risks such as dehydration or diarrhoeal diseases (Hunter et al. 2010). Further, adequate water is required for a quality education, with schools relying on water for many activities including sanitation and hygiene. A shortage of water at home may also result in absenteeism. A recent study conducted by UNICEF, (2021) indicated that a shortage of water may result in malnutrition, making children even more vulnerable to disease. Lack of water also affects hygiene, often impacting on children's school attendance, particularly girls during their menstruation.

Sub-Saharan Africa (SSA) is one of the regions with the highest proportion of urban households. Informal settlements in the Sub- Saharan urban area mostly have no

piped water and water supplies tend to be contaminated and sanitary conditions are poor. This creates health vulnerabilities particularly among children, due to lack of sufficient food and poor nutrition. Worldwide, over 350 million children live in informal settlements (Singh, et al., 2022), with over 1.6 million children specifically in South Africa and one third of these in Gauteng (Hall, 2019). Waterworks is an informal settlement located in the south of Johannesburg, near Lenasia in the Gauteng province, South Africa and was initially established due to its proximity to the busy intersection of the N12 National Freeway and the R558. The plot of land on which the Waterworks informal settlement is situated has been reserved for a proposed development since 2017 (Nkoane, 2019), with part of the settlement falling within City of Johannesburg and the other half within Rand West Local Municipality. The community depends on water tankers with water provided by both Municipalities. However, according to a report conducted by Cirola, (2023) the water tanks are not regularly filled with water, resulting in water shortages.

Access to sufficient reliable and safe water is a need for every human and is protected through extensive legislation. Despite this, children in the Waterworks informal settlement face water shortages, and such conditions are extremely challenging to their health and education. These circumstances may compromise the potential of these children to improve their quality of life. It is therefore important to understand the implications of these water shortages on their health and education as well as to identify strategies used by parents and educators to overcome these water shortages and associated effects.

1.3 Significance of the research

Water is essential to all human beings. In particular, water plays a very important role in keeping children healthy as their bodies develop. Access to safe, reliable water also helps children stay focused in school, allowing them to receive a quality education and means fewer sick days and good hygiene practice. Education is one of the most important factors that can influence breaking the cycle of poverty, especially in informal settlements and rural communities. Therefore, it is important to explore the effects of

water shortages on children's education and health, especially for those children in informal settlements. The research findings could positively influence other stakeholders, such as local government to invest more on sufficient reliable and safe water supply in informal settlements for better childhood development.

1.4 Purpose of the study

The purpose of this study was to explore the effects of water shortages on children's education and health at Waterworks informal settlement.

1.5 The research questions

The following research questions have guided the research being undertaken:

- How do water shortages affect children's education and health?
- How do parents and educators deal with the challenges of water shortages in their children's education and health?

1.6 Research objectives

The research questions above were attained through responding to the following research objectives

- To investigate the effects of water shortages on children's health and education.
- To investigate how parents and educators deal with the challenges associated with water shortages affecting their children.

1.7 Structure of the mini dissertation

This mini dissertation consists of six chapters which are summarised as follows:

- **Chapter one** introduces the background of the study that highlights water shortages and its effects on children's health and education. The chapter also

introduces the purpose of the research and the research questions and objectives. The problem statement and the significance is also provided.

- **Chapter two** describes the main concepts used in this research as well as the theoretical framework supporting the study. The chapter also provides an overview of the literature around the research topic to gain a better understanding of what other authors around the world have explored in terms of this research topic.
- **Chapter three** presents the research approach, the design, the data collection techniques and approach to data analysis. The chapter also discusses the limitation of the study.
- **Chapter four** introduces the reader to the background context of the study area which is the Waterworks informal settlement. It also presents the results of the data collected during research fieldwork.
- **Chapter five** analyses the findings of the research and discusses them within the context of the Human Rights Based Approach.
- **Chapter six** presents the overall summary of the findings and conclusion of the research alongside the recommendations to improve access to water by children in the Waterworks Informal Settlement

1.8 Conclusion

The purpose of this chapter was to introduce the global context of access to water as a human right that is protected by several pieces of legislation, with a particular focus on informal settlements of South Africa. The chapter also identified the role that water plays on children's health and education and the need for this type of study to be carried out. In order to guide the reader further, this chapter also introduced the purpose of the research, describing the research questions and objectives and also provided a summary of the structure of the mini dissertation. The next chapter unpacks some of the conceptual literature in more detail, as well as the theoretical framework supporting the study.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter focuses on the main concepts used in this research as well as the theoretical framework. The first section unpacks concepts such as water shortages, access to sufficient water, informal settlement, education, and health and provides an understanding of the key concepts used in the study. Understanding these concepts is important to lay the foundation for gaining a better understanding of the findings of the study. The final section of this chapter then presents the theoretical framework supporting the study. The study was guided by a Human Rights Based Approach.

2.2 Key concepts

It is crucial in research to often define and describe the key concepts that have been used to help situate the research within a body of literature.

2.2.1 Water shortage.

According to Manungufana (2014: p.1), water shortage refers to *“the impact of low water availability per person”*. Water shortage may lead to insufficient water for household consumption and for the community at large. Manungufana (2014), further indicates that water shortages can be better explained in two dimensions which are economic and physical shortages.

A physical water shortage normally occurs in areas where surface and groundwater resources are insufficient to supply water as per population demands, resulting in high consumption compared to water availability (Manungufana, 2014). Dry regions are most often affected by physical water shortages, but some of the causes associated with physical water shortages include the over-allocation of water resources and rapid

developments without proper upgrades to water infrastructure or without planned water infrastructure.

An economic water shortage is caused by a shortage of investment in water infrastructure or a shortage of human skills to manage the water demand (Manungufana, 2014). This phenomenon also affects places which have adequate water (Manungufana, 2014). In most countries, economic water shortages are more prevalent than physical water shortages, due to the poor management of available supplies or infrastructure, shortages of skilled labour, and misuse of water by industrial, recreational, agricultural, and other sectors. Water is a fundamental natural resource, but humans are responsible to protect water sources and implement methods to minimise water shortages (WHO, 2019). Therefore, managing both physical and economic water shortages depend on the contributions of both nature and human innovation (Manungufana, 2014).

In this study, economic water shortages appear to be more dominant as the community experience water shortages associated with poor infrastructure management rather than a physical shortage of water.

2.2.2 Access to sufficient water

Access to water means that water should be both economically and physically accessible (SAHRC, 2000). Physical accessibility refers to *“the availability of water within a distance accessible to everyone, including children, persons with disabilities and elderly persons”* (SAHRC, 2000:p298). Water should also be economically accessible to all, including the vulnerable and poor individuals. ‘Sufficient water’ refers to the minimum amount of water required to satisfy basic human needs (quantity) and the minimum standards suitable for human consumption (quality) (SAHRC, 2000).

The WHO has proposed that to satisfy basic needs, each and every person needs 50 to 100 liters of water a day to ensure that all their basic needs for drinking, cooking, and hygiene are met (WWAP, 2012). The World Health Organization (WHO) has also developed basic guidelines for accessibility, which determine that the time to collect water should not exceed 30-minutes for a return trip and that the water source must be within one kilometre from a household or educational facilities (WWAP, 2012).

The Constitution of South Africa, 27(1)(b), states that everyone has the right of access to sufficient water (RSA, 1997). The Water services Act (1998) indicates that *“the minimum standard for basic water supply services is a minimum quantity of potable water of 25 liters per person, per day or 6000 liters per household per month...”* It further specifies that water should be accessed within 200 meters of a household and each household or consumer must not experience water access issues for more than seven full days in a year.

2.2.3 Informal Settlements

Informal settlements have been defined by Ghasempour, (2015:p11) as *“residential areas where a group of residential units are developed on lands without legal ownership or reside illegally”*. The terminology of informal settlements differs across countries, with the term ‘slum’ used in Kenya and the term ‘squatter camps’ previously used in South Africa before informal settlements was introduced. In Brazil, informal settlements are locally referred to as ‘favelas’ and in India as ‘shantytowns’, which are typically defined by the attributes they lack (GSG, 2022).

Informal settlements are mostly found in cities and urban areas, although they still exist in rural areas. Most people living in informal settlements are either low-income or unemployed and generally considered as poor groups of people. The housing is mostly constructed with cheap, worn-out materials that have been found, and they often lack traditional urban services (Ghasempour, 2015). Ghasempour (2015), proposed several reasons for why informal settlements are established. The majority of informal settlement residents are migrants who were attracted to the nearby city or suburbs because of the opportunities they present, such as employment. Other reasons include the high cost of land, the lack of adequate housing, immigration, and the lack of job opportunities (Ghasempour, 2015).

United Nations in the definition of human settlement indicated that informal settlements are known by several social ills which include poor delivery of services, unsuitable

shelters, unsafe environment, hardships and social distress (UN-HABITAT, 2005). Based on the several definitions from literature, this research defines an informal settlement as ‘a community that has been established without the intervention of the local government (municipality) resulting in limited basic service delivery’ (Researcher,2024).

2.2.4 Education

According to Prasad and Gupta (2020:p1), *“education is a tool which provides people with knowledge, skill, and information and enables them to know their rights and duties toward their family, society as well as the nation”*. Good education plays a crucial role in the modern, industrialized world. It develops the competencies to contest inequality, violence, poverty, corruption, and many other issues that affect people's lives (Prasad & Gupta, 2020). Being deprived of an education can limit one to new ideas and affects the development of the individual. Doharey, et al., (2023) defined education as *“a process that helps people gain new knowledge and skills from one another, in order to use this knowledge and skills for the development of the world and to improve their lives”*. Such knowledge and skills are not only limited to formal institutions such as schools, but can also be gained through informal means such as interaction with the environment and self-learning (Doharey, et al., 2023).

When children stop going to school or learning due to a lack of basic services such as water supply, the right to education is violated (Mirugi-Mukundi, 2014). This is more commonly noticed among girls of menstruating age. Access to water services in schools is important especially for girls of menstruating age to manage their periods with dignity. In 2018, it was estimated that one in four girls in Nigeria missed school due to their menstruation (UNICEF & WHO, 2020).

The United Nations Children’s Fund (UNICEF) acknowledged the critical role schools play in creating a secure and healthy environment which provide sanitation facilities and clean water (Loeffen, 2021). Educational organizations play a pivotal role in advocating vital change in behaviour that impacts the improvement of beneficial life skills that are central to good health and hygiene (Loeffen, 2021). The right to education means availability, acceptability (crucial for dignity and safety, especially for

girls), accessibility (particularly children and disabled), affordability (especially the vulnerable group), and quality of education. The rights to water and sanitation in schools and communities is related to improving and promoting the rights of children to education.

2.2.5 Health

The Australian Institute of Health and Welfare, (2018: p1) defined health as a “*state of wellbeing*” which indicates the complex connections of a person’s genetics, lifestyle and environment. According to Huber, et al. (2011: p. 2), health is defined as “*the ability to adapt and self-manage in the face of social, physical, and emotional challenges.*” A person’s health is influenced by a number of factors and can be characterized in three domains, which include physical, mental, and social.

Physical health is when a healthy organism is capable of maintaining physiological homeostasis through changing conditions (Huber, et al., 2011). Physical health can be defined by how well your body systems and organs function. A healthy body system and organs can stand a defensive reaction, reducing the possibility of getting injured or ill and restoring balance (Huber, et al., 2011). Conversely if these organs and body systems do not function effectively, it may result in sickness. Some of the factors that may affect physical health include access to basic services, lifestyle and the environment.

Mental health describes the intelligence of consistency as a factor that contributes to a successful capacity to cope, recover from strong emotional stress, and prevent “post-traumatic” stress conditions (Huber, et al., 2011).

Social health has numerous dimensions that can be recognised, which include the ability of people to attain their goals, succeed in life and participate in social activities in spite of their handicap (Huber, et al., 2011).

This study focusses on the physical health aspects. The physical health of children depends on the physical environment at Waterwork informal settlement, and what basic services they have access to. A shortage of water for example can affects their

lifestyle in terms of diet and how they practice personal hygiene. Shortages of water or dirty water can result in digestive issues which can compromise physical health.

2.3 Literature Review

Having defined the main concepts in this research, this section reviewed the literature in order to understand the dynamics of the research topic and also to gain a better understanding of what other authors around the world have explored in terms of this topic. The importance of this literature review is to understand how children in informal settlements are affected by water shortages, in terms of their health and education.

2.4 Water as a human right

Water is recognised as a human right in public international law. The right to water is a basic need for the survival of persons and critical for the future of humanity. Some of the key international human rights instruments include:

2.4.1 United Nation (UN) Charter

One of the purposes of the United Nation is to promote and encourage respect for human rights and freedom of peoples (UN Charter, 1945). Article 55 of the UN Charter mandates:

- *“Higher standards of living, full employment, and conditions of economic and social progress and development”;*
- *“Solutions of international economic, social, health, and related problems; and inter- national cultural and educational cooperation”*
- *“Universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language or religion”.*

2.4.2 Universal Declaration of Human Right (UDHR)

The transcript of the Universal Declaration on Human Rights was adopted by the General Assembly in 1948; however, it was not binding. The right to adequate housing and water has been recognised internationally in the Universal Declaration on Human Rights. Scanlon, et al., (2004) indicated that many of its provisions are now considered to be customary international law in many legal instruments. Article 25 declares that *“everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing, medical care, and necessary social services...”* Although water is not mentioned in this article, one may argue that water was considered to be implicitly included, because the term “including” indicates that the elements mentioned are not meant to form an all-inclusive list but help as a guideline for certain essential elements for an adequate standard of living (Scanlon et al., 2004). Furthermore, for a person to have an adequate standard of living, a sufficient water supply is needed to maintain their health and well-being.

2.4.3 Sustainable Development Goals (SDGs)

The 2030 agenda for sustainable development was adopted on 25 September 2015 by all the United Nations General Assembly members, with the aim of addressing the gaps of the Millennium Development Goals (MDGs) and to monitor progress on sustainability of development interventions across the world (Wilkinson, et al., 2019). The Sustainable Development Goals (SDGs) implemented by the UN general assembly contain 17 goals with a number of targets. Many countries around the world shifted focus from the MDGs to the 17 interdependent thematic SDGs. In South Africa, the National Development Plan incorporated 70% of the SDGs into its plan.

SDG 6 states that every country must ensure sustainable management and availability of water and sanitation for all by 2030. In a report by the UN in 2022 it was indicated that with the current rate of progress, the world would only achieve 81 percent coverage by 2030, missing the target and leaving 1.6 billion people without access to water as a basic need (UN, 2022). It is the responsibility of all member states to make sure that every citizen can afford water and sanitation services, including free provision

for those who cannot afford to pay. Water must be available in sufficient quantities continuously for drinking, food preparation, sanitation, and personal hygiene.

2.5 Legislative Frameworks on access to water in South Africa

In order to achieve the commitments on water rights set out in the Constitution of South Africa, several policies, legislation and strategies have been developed by the South African government. Some of the important legislation about the water rights in South Africa are discussed below.

2.5.1 Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of South Africa outlines the foundation of democracy in the country. Chapter 2 encompasses the Bill of Rights of the Constitution, which protects the rights of all citizens including children and affirms the democratic values of human dignity, equality, and freedom (Constitution, 1996). Section 27(1)(b) of Chapter 2 clearly articulates that *“everyone has the right to have access to sufficient water and food”* (Constitution, 1996). Section 28 further states that *“every child has the right to basic nutrition, shelter, basic health care services, and social services”* (Constitution, 1996). In order to ensure that all the rights of all citizens are respected, promoted and fulfilled, the constitution under Section 152 states that *“it is the responsibility of local government to ensure the provision of services to communities in a sustainable manner; to promote a healthy and safe environment for all the rights of the citizens”* (Constitution, 1996). The constitution further directs the national and provincial governments to support and strengthen the capacity of municipalities to perform their functions under Section 154(1) (Constitution, 1996).

The Constitution thus lays the basis for the right to access sufficient water and allocates the responsibility of delivering water to the communities to the municipalities. After the 1996 constitutional dispensation, there were huge differences and even injustices with respect to access to services including water. Accessing water is still

not possible for all citizens in South Africa, due to its history and policies which mostly affected the vulnerable groups in society (IPEC, 2012). Those living in the informal settlements continue to experience significant challenges in terms of the delivery of services, including that of water.

2.5.2 National Water Act (No. 36 of 1998)

The National Water Act (NWA) is mandated by Section 24 of the Bill of Rights in the Constitution of South Africa. It states that *“everyone has the right to an environment that is not harmful to their health or well-being, and the right to a protected environment for the benefit of present and future generations through reasonable legislative and other measures”* (Constitution, 1996). The National Water Act aims to redresses past inequalities of water during the apartheid regime and recognises that water belongs to everyone. It sets out to develop a national framework to develop, conserve, manage, and control water resources within the country. It further promotes integrated management through Integrated Water Resource Management (IWRM) for participation of all stakeholders in water resource management and equitable allocation of water for beneficial use.

2.5.3 Water Services Act (No. 108 of 1997)

The Water Services Act (WSA) stipulates that everyone has the right of access to basic water supply and sanitation services. It is a constitutional right for each individual to access sufficient water, and the constitution has given the responsibility to fulfill the right to access water to municipalities or Water Services Institutions (WSI) (Constitution, 1996). The Water Services Act (WSA) 108 of 1997 stipulates that Water Services Institutions should have well-detailed service development plans and be responsible for manageable measures to ensure that the constitutional rights are reached (Mahlasela, et al., 2020).

Section 9(1) of the Water Services Act, has promulgated regulations relating to compulsory national standards and measures to conserve water. This Act has

introduced a free basic water policy that attempts to redress poverty that is experienced by many South Africans. The purpose of the policy was to ensure that no one is deprived of access to basic water supply due to their inability to pay for the service. The policy further states that *“the minimum standard for basic water supply services is a minimum quantity of potable water of 25 liters per person, per day or 6000 liters per household per month, at a minimum flow rate of not less than 10 liters per minute; within 200 meters of a household; and with effectiveness such that no consumer is without a supply for more than seven full days in a year”*.

2.5.4 Informal settlement in the international context

Housing is a continuous challenge all around the world, especially in developing countries. According to (UN-HABITAT, 2005) the percentage of people residing in informal settlements has doubled in number in the last few years. It is estimated that over 1.6 billion people live in inadequate housing worldwide, of which 1 billion of them live in informal settlements and slums (UN-Habitat, 2022). The report by GSG (2022) indicates that one in eight of the world’s population lives in terrible conditions, with no access to basic infrastructure, such as running water or sewage, or a decent shelter. The development and increase of informal settlements around the world are due to a number of reasons, which include international and internal migration, economic impoverishment and stagnation, urbanization and population growth, unemployment, social conflict and poverty (UN-Habitat, 2022). These challenges lead to a shortage of affordable housing, insufficient infrastructure and a lack basic services (UN, 2022).

2.5.5 Informal settlements in South Africa

In 2012, the Housing Development Agency (HAD) reported that South Africa has about 2 700 informal settlements with 1.2 million households that were without adequate access to basic services, especially water (Muzondi, 2014). A general Household Survey report from Statistics South Africa also indicated that approximately 1 in 5 households in metropolitan areas lived in informal settlements (STATS SA, 2018). In 2019, South Africa's (Stats SA) General Household Survey indicated that 12,7% of South African households lived in informal settlements with approximately 51% from Gauteng province (The Department of Human Settlements, 2021). The South African Census 2022 Statistical report indicated that Gauteng Province has the second highest percentage of households residing in informal settlements, with approximately 11% (Department of Statistic, 2023).

According to the South African Constitution of 1996 Section 26, all people have the right to "access to adequate housing" (RSA, 1997). However, many people still live in shacks, with limited to no proper sanitation facilities, no running water and electricity and often established illegally on municipal or private land. The South African government has tried to provide water tanks to some of these informal settlements in order to address the fact that large numbers of people live in informal settlements with no running water and sanitation (Morgan, 2019). However, often this water supply in informal settlements is not reliable in terms of quality, availability, quantity, and accessibility.

2.5.6 Water Shortages in informal settlements in the international context

According to UNICEF and the WHO (2019), about 2.2 billion people lack access to clean drinking water worldwide, as cited by Salehi (2021). In 2020, two billion people were without safely managed drinking water services, with 1.2 billion people lacking basic water services due to urbanization, rapid population growth, and rapid pressure from other sectors such as industries and the agriculture sector (UN, 2022). Several

urban and rural regions of the world have experienced a rapid decline in freshwater resources and aging water infrastructure, making it difficult for many water utilities to address high water demand (Salehi, 2021). Changes in global climate, resulting in increased drought, is one of the factors contributing to water shortages. The most vulnerable in society have been the most affected group due to affordability. The solutions employed by many water utilities to manage the water shortage mostly focus on encouraging consumers to look for alternative sources of water, such as rainwater harvesting, use of containers for storage, water reuse, and reducing water consumption (Salehi, 2021).

As a result of water shortages, many households in regions such as the Middle East, South America and Africa use in-house storage containers to have some form of backup water for times of water supplies interruption or low water pressure, mostly in summer seasons when the demand for water is high (Salehi, 2021). The storage containers are mostly made from polyethylene, galvanized iron, strengthened concrete, and fiberglass. These containers' materials could influence the spread of pathogens such as *Legionella* and *Pseudomonas* which could impact human health (Peter & Routledge, 2018). Increased water temperature in tanks or containers due to the penetration of sunlight could affect the quality of water and promote microbial growth (Peter & Routledge, 2018). Salehi (2021) indicated that although alternative practices of supplying water have been implemented to address the water shortages and ensure that consumers are supplied with clean water supply, water utilities need to conduct a monitoring practice before and after the supply of water to avoid contamination of delivered water.

Twenty-two percent of population in Mexico City, lives in informal settlements, making water provision more complex (Gutierrez, 2019). Aquifers provide two-thirds of Mexico City's water supply, and the remaining is imported from surface water which is then distributed to people through massive network of pipelines that makes it difficult to reach informal settlements (Gutierrez, 2019). The informal settlements buildings are characterised as unplanned housing constructed on land not designed for housing with cheap, insecure materials, often lacking basic services. Due to the water supply

being too costly or unaffordable, many informal settlements depend on other source of water that they can afford. Some of the common alternatives include illegal pipe connections and “*pipa*”. *Pipa* is a system that truck uses to transport potable water on-demand to risky areas with lack of service and remote locations such as informal settlements (Gutierrez, 2019). Originally most of *pipas* were supplied by the government, but currently there is a huge network of *pipa* routes that are organised by informal mediators. The Mexican government does not lawfully recognize the informal *pipas*, but it has started to allow them and even encourages them to provide the water (Gutierrez, 2019).

In Namibia, a study conducted by Maemeko, et al., (2021) highlights the social challenges faced by learners residing in informal settlements in Katima Mulilo Town . The informal settlement is a result of urbanization as people migrated from rural settings to urban areas to seek better living conditions and search for jobs (Maemeko, et al., 2021). However, not everyone who moves to urban areas gets jobs, which results in informal settlement build-up and the living conditions in these informal settlements are poor (Maemeko, et al., 2021). Most of the houses are built with corrugated iron sheets and poles, also roofed with corrugated iron sheets. These houses are usually small and built close to each other, and one house can accommodate more than five people (Maemeko, et al., 2021). These informal settlements lack clean piped water for people to drink, the roads are poor, they lack sanitation facilities, and there are poor electricity connections. The study found that the conditions of those informal settlements are unacceptable. In particular, findings showed that learners in these informal settings face a number of social challenges including expensive water and electricity bills, poverty, unemployment, high crime, poor sanitation, and a limited sewage disposal system (Maemeko, et al., 2021). To overcome these challenges, the study recommended that the local authority implement projects of installing sewage lines and water systems that will improve the sewage system to prevent the development of organisms that cause diseases and then prevent learners from absenteeism from school when they are sick (Maemeko, et al., 2021).

The crowding of cities in most African countries is most noticeable in the informal settlements, with over 60% of the urban population crowded in informal settlements (John-Nsa, 2021). Shortages of water for the most vulnerable residents in urban areas who live in informal settlements are emphasized by an extensive lack of access to piped water services (UNICEF, 2021). Most water shortage literature focuses on the quantity of water. However, the quality of the water delivered to the consumers during the water shortages could be threatened if the safety procedures are not followed (Salehi, 2021).

2.6 Water shortages in the informal settlements of South Africa

After South Africa attained democracy in 1994, the government announced the Universal Water Supply Declaration, which ensured that all citizens receive equal access to water supply (Muzondi, 2014). South Africa also joined other nations in shifting focus from MDGs to 17 interdependent thematic SDGs in order to monitor progress on sustainability of development interventions (Wilkinson, et al., 2019). Given that South Africa is classified as a water-stressed country, with only about 1.1 million liters of water available per person per annum, water supply still remains a challenge, despite the halving of the water service backlog (Muzondi, 2014). High urbanization and industrialization trends contribute to water service backlogs, which mostly affects poor residents in urban areas and the most vulnerable. Communities living in informal settlements of Cape Town represent an estimated 10 to 15 percent of the city's overall population, the population uses only five percent of total city water consumption (UNICEF, 2021). The provision of water in the informal settlements is far below the standards required by legislation (Muzondi, 2014). Water use in informal settlements is often controlled by the volume of water that one is able to carry (UNICEF, 2021). Residents from Cape Town informal settlements used 50 litres per person per day on average both before and during the day zero crisis.

The right to water is a basic need for human survival and should be accessible to all. In response to the failure of most developing countries to supply sufficient clean water to their citizens, the WHO has proposed that for basic needs, each person needs 50

to 100 liters of water per day to ensure that all human basic needs for consumption, hygiene and cooking, are met (WWAP, 2012). The World Health Organization (WHO) has published basic guidelines for accessibility, which determine that the water source must be within one thousand meters from the household or educational facilities and the period to collect water should not surpass 30-minutes for a return trip (WWAP, 2012). It is important that access to water be acceptable, depending on safety and dignity, and should also be supplied in a way that respects local cultural practices.

For this reason, standards and conditions of living in any human settlement are effectively determined by the availability and accessibility of water. In South Africa, legislations such as the 1996 Constitution, the National Water Act (NWA) and the Water Services Act were implemented in an effort to challenge the service delivery backlogs as discussed above. The protection of access to clean drinking water for human consumption is one of the services protected by these legislations.

2.7 Children living in informal settlements

The survival, development and protection of children depend critically on having access to adequate housing and safe environments. According to Singh et al., (2022) around 350 to 500 million children under the age of 18 years are living in informal settlements and slums around the world. The conditions of informal settlements can disrupt children's rights to an adequate standard of living needed for their physical, mental and social development (Singh, et al., 2022). Children who live in informal settlements are arguably among the most vulnerable groups in the world, because their rights to access basic needs such as safe water, sanitation services, housing and wellbeing are compromised and they depend on others and their surrounding environment to meet their development needs and basic needs for survival (Save the Children, 2006). Overcrowding in informal settlements also impacts children's health, safety, and security and compromises their ability to experience early childhood development (Singh, et al., 2022).

The study by Singh, et al., (2022) highlighted that many families face conditions of life-threatening poverty where children are expected to become independent at a young age. This could include children being subjected to harmful child labour or moving out of the family home. The study further elaborates how providing children with access to adequate housing contributes to the eradication child poverty, enhance health, lessens gender inequalities, creates enabling educational environments, increases access to basic services, improves well-being and safety (Singh, et al., 2022). Adequate housing is also a key contributor to achieving the Sustainable Development Goals and building a sustainable future for the next generation. Several studies have concluded that children living in informal settlements often have less access to education and lower knowledge levels than their peers in rural and urban area settings.

2.7.1 Effects of water shortages on children's education.

According to Save the Children (2006), both the long-term and immediate effects of water shortages on children's education have not been given much international attention. Access to reliable water is one of the most important factors in order to achieve better education. The socio-economic status of parents and the economic constraints of governments have placed children from the poor and middle class at a disadvantage in terms of quality education due to a lack of basic services such as water supply. This has resulted in some children not attaching much value to education (Department of Basic Education, 2021).

According to the Department of Basic Education, (2013) some of the sources of water supply in South African schools include a municipal reticulation network, rainwater collection systems, mobile tankers, and boreholes. The high rate of population growth and developments in the country have increased pressure on the water supply system, including water supply in schools (UNICEF, 2012).

Further, a study conducted by IPEC (2012), shows that the impact of water shortages negatively affects educational outcomes for children. Children miss school during

water shortages due to illnesses from water-related diseases and sanitation and hygiene issues (Save the Children, 2006). This has also resulted in some of the children dropping out of education. In addition, one of the major contributors to absenteeism from school in developing countries is water-related diseases such as diarrhoeal diseases. It is estimated that 443 million school days are lost annually due to diarrhoeal disease around the world (Save the Children, 2006). According to UNICEF (2012), achieving global goals that are related to safe water supply and sanitation could save an estimated 1.9 billion school days and reduce the incidence of diarrhoeal illness around the world.

This can be achieved by supplying communities and schools with clean reliable water, better sanitation facilities, and hygiene education that promotes the development of healthy behaviours for life. The research done by Kotingo , et al., (2014) indicated that every child or member of school staff should have access to 5 litres of drinking water per school day. An additional 10 to 20 liters of water per individual should be accessible every day during school days for flushing the toilets (Kotingo, Ayerite, & Chukwuma, 2014

As the school environment is where children spend most of their time, insufficient access to water at schools can result in a number of health issues including learners suffering dehydration, which can impair their ability to focus and have long-term negative effects on their health and education (Kotingo , et al., 2014). It is thus vital that schools have access to safe and reliable water for good health, hygiene, and uninterrupted education (UNICEF, 2012). This is particularly important in light of the importance of good education in the developing world (UN, 2022).

In addition, a study by UNICEF (2012) indicated that attendance at school for adolescent girls during menstruation requires girls to have an appropriate water supply for washing hands after the change and discarding of sanitary pads in provided containers. Shortages of water and inappropriate facilities for adolescent girls results in poor hygiene and can affect their comfort in class or result in absenteeism (UNICEF,

2012). Girls' absenteeism from school has a long-term economic effect on girls, since educated women are more likely to raise well-nourished, healthy, educated children, acquire skills to contribute to their societies and protect themselves from abuse and sexually transmitted diseases (UNICEF, 2012).

The long-term impact of water shortage can also have a serious effect on hygiene education and practice behaviours, as without appropriate opportunities to learn, children will continue to practice poor hygiene. These behaviours become entrenched and therefore become difficult to change (UNICEF, 2012). Moreover, it's not only the availability of water in the school environment that effects education outcomes. SDG 4 quality education, states that children perform better in school if they have access to adequate housing with sufficient space, light, electricity and other basic services which leads to better school attendance rates (UN, 2022).

2.7.2 Effects of water shortages on children's health

Water is an essential nutrient for the lives of all humans (WHO, 2003). Humans cannot survive for more than a few days without water because it plays an important role in protecting the immune system, which is the body's natural defence system that helps to remove waste matter (WHO, 2003). Sixty percent of the human body contains water, which plays a crucial role in almost every part of the body (WHO, 2003). According to a report by Wilkinson, et al. (2019), the availability of safe drinking water is one of the most important requirements for the survival and health of the people. Shortages of water supply deprived children's health both directly and indirectly (Huber, et al., 2011). Therefore, reliable water supply characterizes important opportunities to improve children's health.

Water shortages exposes children to many water-related diseases, dehydration and malnutrition (Wright, et al., 2023). According to Save the Children, (2006) water-borne illnesses are responsible for occupying more than half of hospital beds worldwide, with

high death rates in informal urban settlements where sanitary services are poor and access to safe water is inadequate.

One of the most common waterborne diseases is diarrhoea. The causes of diarrhoea include a wide range of viruses, bacteria, and parasites as a result of unsafe water supply and shortage of water supply resulting in poor practice of hygiene. Diarrhoea is one of the most common reasons why children are absent from school (UNICEF, 2012).

In addition, there is also a direct link between diarrhoea, worm infections, and hygiene in schools (UNICEF, 2012). Worm infections are spread through poor hygienic environments in soil or water and through poor hygiene when preparing or eating food, this infection is mostly common in children living in extreme poverty conditions and in primary school children (UNICEF, 2012). The major worm infections of children include the roundworms (ascariasis), whipworms (trichuriasis), and hookworm (*Necator americanus*). Hookworm infections penetrate the skin through contaminated soil and leads the intestinal worm infections because their important role in causing anaemia (Weatherhead & Hotez, 2015). The Roundworms and Whipworms occur through ingestion of contaminated soil or food and reach maximum age intensities among preschool and school-age children (Weatherhead & Hotez, 2015). Worm infections can easily spread among groups of children because they play together, touch each other, and poor practice of hygiene after using the sanitation facilities (not washing hands with soap afterwards). Worm infections also affect the physical and intellectual growth development of the child. Due to water shortages, the physical growth of children can also be seriously affected. (Hunter, et al., 2010). Therefore, the availability of water in childhood development is crucial to children's health.

Regular hydration is also important in children's health. Adequate consumption of water is required to balance the normal concentration of total body water. According to a German study, children's short-term memory and mental capacity are positively impacted by drinking more water during school hours (Drozdowska, et al., 2020).

Furthermore, rapid dehydration is mostly dangerous in younger children and can be because of decreases in total body water (Chouraqui, 2023). Chouraqui, (2023) further elaborated that dehydration contributes to development of several diseases including impaired mental performance of school children. Limited research has studied the impact of inadequate water consumption or lack of access to drinking water on children's mental, socio-emotional, and motor development (Wright et al., 2023). Most of the studies showed that sufficient water consumption potentially improved child development and health (Wright, et al., 2023).

2.8 Theoretical framework

A theoretical framework is a specific collection of theories that relate to the topic or event under investigation and existing opinions (Du Plooy-Cilliers, Davis, & Bezuidenhout, 2014). The importance of a theoretical framework is to assist in identifying relevant main variables in research (Du Plooy-Cilliers, Davis, & Bezuidenhout, 2014). It also gives guidance as to how to structure the research questions that need to be answered, analysed and interpret the data. There is a need to develop a theoretical framework that classifies the general understanding of the effects of water shortages on children's education and their health development. The study was informed by the Human Right- Based Approach.

2.8.1 Human Rights- Based Approach

The key basis of the Human Right- Based Approach (HRBA) framework was formed by the Universal Declaration of Human Rights (UDHR) of 1948 and other international human rights instruments (UNICEF , 2015). A Human Rights-Based Approach is supported by several international human rights law and acknowledges all human rights, which include civil, cultural, economic, political, and social protection rights (Parra, 2012). According to UNICEF (2015: p.8) HRBA *“is a conceptual framework for the process of human development that is normatively based on international human rights standards and operationally directed to promoting and protecting human rights”*.

The implementation of the HRBA across the United Nations was supported by Secretary General Kofi Annan in 1997 (Loeffen, 2021). Its objectives are to capacitate people to claim and exercise their rights and to improve authorities' ability to uphold their obligations, respect, protect, and satisfy the rights of the vulnerable (UNICEF , 2015). Therefore, HRBA is an instrument used to reach all people including the poorest and most vulnerable into any and every development in order to strengthen their human rights.

The main principles of human rights include equality and non-discrimination, access to information, participation, sustainability, and accountability to guide the entire project management cycle (Loeffen, 2021).

The **equality and non-discrimination** principles are aimed at promoting equality and no discrimination in terms of age, race, gender, colour, culture, belief, language, political opinion, property, disability, and other status (UNICEF , 2015). Thus, everyone is equally allowed to have rights as defined by Article 2 of the Universal Declaration of Human Rights (UDHR) of 1948 and endorsed by national human rights treaty bodies (UNICEF , 2015).

Access to information is also important as a human right to water. It implies that all individuals have a right to access information about the government's water plans and policies, with transparency in all roles and responsibilities and also allow residents to participate and demand accountability in order to benefit from services (SDC, 2018).

The HRBA is aimed at eradicating inequality and discrimination through promoting of the right to **participate** in key decision-making processes directly and indirectly in order to empower all individuals (Loeffen, 2021). Further, the UN Declaration on the Right to Development (UNDRD) acknowledges that all individuals are allowed to freely participate in all developments including social development to their satisfaction of

their human rights (UNICEF , 2015). The role of HRBA in participation is to empower children to demand their rights and institutions or government to promote the participation of children in community programs.

The concept of **sustainability** is also key to the HRBA, as it's required in order to ensure environmental rights, intergenerational equity and inclusive participation (Loeffen, 2021). Sustainability requires all individuals including the institutions to be mindful of future generations and maintain the balance among social, economic, and environmental sustainability (Loeffen, 2021).

Another important concept to the HRBA is the principle of **accountability** which allows all rights-holders to comply with the rules and procedures provided by the law in exercising their rights. It also protects the rights-holder by ensuring that institutions respect and satisfy human rights (Loeffen, 2021). The international, national and regional laws have different penalties for individuals or institutions that violate human rights in accordance with the rules and procedures provided (UNICEF , 2015). According to UNICEF (2015), accountability can be achieved through strengthening and educating children about their rights, amendments of laws and policies by the responsible institutions, and adult's attitudes and behaviours towards children's rights.

Since the year 2000, social rights have gained more attention due to the implementation of the Millennium Development Goals (MDG) agenda. Although the implementation of MDGs gave less attention to social rights and many other rights, the idea was transformed by introducing the 2030 Agenda for Sustainable Development Goals (SDGs), which was approved by countries across the world in September 2015. The social rights receive explicit attention in three of the 17 Sustainable Development Goals (SDGs), which are to end poverty in all its forms everywhere (Goal 1), achieve gender equality and empower all women and girls (Goal 5), and reduce inequality within and among countries (Goal 10) (Loeffen, 2021).

At the national level, a strong legal and institutional framework should be utilised to ensure the realisation of all human rights. According to UNRISD (2016), the incorporation of a HRBA in designing, implementing, and evaluating social rights depends on the outcome of the legal and institutional requirements in the constitutions. South Africa's 1996 Constitution recognizes a range of social rights, such as the right to education (section 29), water (section 27), and health (section 27), under Chapter 2 of the Constitution (RSA, 1997). It also sets comprehensive social protection rights for children and seniors (Chapter 7) (RSA, 1997).

A HRBA allows people to take action for change rather than accepting whatever the government is willing to give them. It also supports all people in the country including the poorest and the most vulnerable to receive basic health care, education and water that is accessible and affordable through responsible government departments. The government departments can achieve this responsibility by allocating the required budget in a way that benefits all the people including the poor, this means that basic services must be accessible, affordable for all people, and providing access to safe sufficient drinking water.

In addition to the Core Principles, a key aspect of the HRBA is the cross-cutting principles in support of the social rights, which are: availability, acceptability, affordability, accessibility, and quality (Loeffen, 2021). These five cross-cutting principles ensure that basic services do not only concentrate on availability (quantity) and quality but include all the principles for social rights (Loeffen, 2021). According to Loeffen (2021), the five cross-cutting principles of human rights-based approach are often misunderstood. This study acknowledges all five principles of a Human Rights-Based Approach Figure 2 below visually indicates the relationship between the core principles and these five cross-cutting principles of right to water and its mediating effect on education and health which have been explored as part of this study. The red square indicates the specific focus of this study.

In this study availability refers to the availability of water required per persons per day. Sufficient water must be available continuously for personal and domestic uses, including household hygiene. It has been estimated that 50 to 100 litres per person per day is an adequate quantity of water to meet health requirements (WWAP, 2012).

Acceptability means that water services should be provided in a way that accommodates local cultural practices, in order to be truly acceptable (Loeffen, 2021). Water must also be acceptable in terms of colour, odour and taste (SDC, 2018). Water facilities should be culturally and socially acceptable.

To meet affordability, governments are required to ensure that the community can afford water services, the assessment should be based on local challenges and situations faced by the community. Loeffen, (2021) indicated that affordability can be achieved by considering low-cost technologies, implementing proper pricing policies including free provision for those who cannot afford to pay.

Accessibility is important to water for hygiene and health purposes. Children need to have a convenient water source in order to practice good hygiene and for drinking. The basic guidelines developed by the World Health Organization (WHO) indicates that the time to collect water should not exceed 30-minutes for a return trip and that the water source must be within one kilometre from the household, schools and other institutions (WWAP, 2012).

Water quality refers to the safety of water for consumption, this must be free from microorganisms, chemical substances or any other hazards that can cause a threat to human health (Loeffen, 2021).

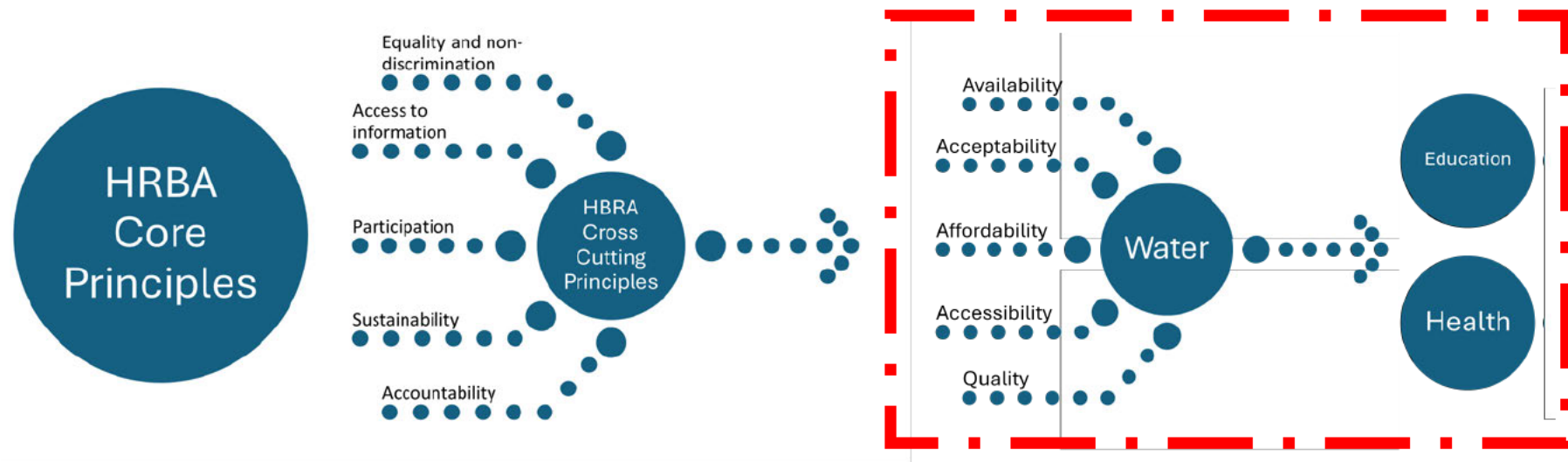


Figure 2: Human Right-Base Approach cross- cutting principles to water rights

2.9 Conclusion

This chapter unpacked the key concepts related to this research and laid out the important literature on the topic, highlighting the complexity of water shortages in informal settlements and the potential implications to both health and education. The availability of safe and reliable water for all consumers is key to achieving the SDGs and other global goals. But many countries including South Africa still face challenges with water shortages, especially in informal settlements. The study done by Salehi, (2021) also recognizes that the existing water shortage is growing rapidly and affecting several communities worldwide, and this challenges the achievement of SDGs.

Further, shortages of water supply can affect health and education both directly and indirectly. Water plays a critical role in the development of children and may cause major health effects. The challenging living conditions in informal settlements may lead to cycles of continuous poverty and also pose a significant threat to the health of children (Thorne , et al., 2021).

Whilst South Africa has sufficient legislation tools to support the supply of adequate safe drinking water to all citizens, the challenge is in the implementation and management of those legislations (De Kock, 2021). The strength of the many policies and legislation has not always translated into improved service delivery in South Africa, mostly as a result of a lack of capacity at service providers or Local Government level (UN-Habitat, 2017).

The recognition of water as a human right may be important for achieving both international and national human rights aspects for sustainable development in water supply. This can provide a better sustainable water supply for the needs of all communities. However, WHO (2003) indicated that international human rights law involves specific obligations regarding access to safe drinking water even though water has not been specifically acknowledged as a stand-alone human right in

international treaties. Countries are therefore required to guarantee that every human being has access to adequate clean drinking water.

Human rights-based approaches to water rights, however, have been prioritised in many parts of the world. Work still needs to be done to ensure that water supply meets all the principles of the HRBA to all individuals including the poor and most vulnerable. The HRBA is helpful as it frames water as a human right, making it possible to discuss water shortages in a specific context in terms of the cross-cutting principles which include availability, acceptability, affordability, accessibility, and quality (Loeffen, 2021). In this way, this study frames water shortages in the Waterworks Informal Settlement not just as a public service challenge but also as a human rights issue.

The following chapter sets out the research design and methodology that was used by this study in answering the research questions. It is followed by the findings and then discussion which is framed in terms of the HRBA.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Research design according to (Sileyew, 2019), provides the overarching approach that the researcher has followed to obtain the relevant information for the study. Research methodology on the other hand defines the way in which data should be collected and how it should be analysed once collected, functioning as a guideline to the researcher (Sileyew, 2019). This study used semi-structured interviews to determine how parents and educators feel about the effects of water shortages on the education and health of children within the Waterworks informal settlement, together with field observations at the schools and community. In order to present the research design and methodology, this chapter discusses, the research paradigm, the data collection methods and procedure followed to collect the data, together with the data analysis techniques, sampling procedure and size, validity and reliability, and limitations of the research. Ethical considerations are also presented and discussed.

3.2 Research paradigm and approach

According to Antwi and Hamza, (2015:p.218) *“the selection of research methodology depends on the paradigm that guides the research venture.”* The term paradigm simply means an approach to thinking about how research should be conducted and how findings should be interpreted (Antwi & Hamza, 2015). A paradigm therefore provides guidance on how to structure academic ideas when doing research. According to Du Plooy-Cilliers, Davis, and Bezuidenhout (2014), it is important to know the paradigmatic approach because it guides the researcher on questions that can be considered during the investigation and what procedures are required to answer those questions accordingly. There are three key paradigms to consider when conducting research: positivism, interpretivism, and critical realism.

These three paradigms differ from one another in terms of the aims of research, the types of knowledge, and what procedures of data collection and analysis are used (Du Plooy-Cilliers, et al., 2014). The understanding of these paradigms gives the researcher a clear direction on matters that they would like to establish or address. When selecting a paradigm, it is important to consider where the emphasis on thinking lies, the specific problem to address, and several other aspects (Du Plooy-Cilliers, et al., 2014). For this research, I have followed an interpretivist paradigm since it applies to the social sciences and investigates the study of human behaviour, beliefs, attitudes, and perceptions of people within their environment. It also provided me, as the researcher, with the understanding of human behaviour. Further, it is usually not interested in generalizing beyond the particular people who are affected in a particular study (Antwi & Hamza, 2015). It looks more at how to gain more understanding of how human beings see the world through their experiences.

Du Plooy-Cilliers, et al., (2014) further indicate that interpretivist research aims to gain an in-depth understanding, which often requires the researcher to spend more time in direct contact with those being studied to be able to appreciate how they experience their daily life. The truth of the interpretive paradigm approach is dependent on people's interpretation of facts, and one cannot generalize the context in which the study was conducted. Thus, the findings of this research cannot be generalised to other communities who are facing similar challenges. According to Du Plooy-Cilliers, et al., (2014 p:29) interpretivists *"believe that truth is dependent on people's interpretation of facts, they are not interested in generalising their results. As a result, the research methodologies they use are sensitive to the specific context and never generalised beyond the context in which the study was conducted."* Therefore, the knowledge from this study cannot be generalised to all children living in the informal settlements of South Africa.

Qualitative data generation methods and qualitative methodologies are often used within an interpretivist approach. The main purpose of qualitative research is to understand human experiences and to communicate human views through interacting with or observing the participants in a comfortable setting usually achieved through

fieldwork (Antwi & Hamza, 2015). Qualitative data are mostly non-mathematical, which means that the information is gathered in the form of words and sentences sometimes directly from human participants. In most cases, such data captures feelings, emotions perceptions of the situation, and the person's actual experiences (Antwi & Hamza, 2015). The researcher has adopted a qualitative, interpretive research approach to understand the impacts of water shortages on the education and health of children within the Waterworks informal settlement. In qualitative research, the researcher has more opportunities to adjust the ways variables are measured as the study unfolds, taking advantage of new developments of the study (Babbie, 2013).

3.2.1 Target Population

According to Wiid and Diggines (2014, as cited in Du Plooy-Cilliers, et al., 2014) the target population of a study is the total group of units or people from whom data is required. This study explored the effects of water shortages on children's education and health. However, considering the age, maturity, and developmental stage of the children as well as institutional ethical considerations, the required data was collected from the parents and the educators. The role of the educator was to explain the complexity of water shortages on children's education as they are the most relevant people monitoring children's education whilst the parents provided information on more of the day to day effects. Therefore, the target population for the research was both male and female parents of children living in the Waterworks Informal Settlement and educators from the common schools that learners in the settlement attend.

3.3 Data collection, analysis, procedure and methods

One of the most important phases of conducting research is data collection. Data collection *"is the process of collecting data aiming to gain insights regarding the research topic"* (Taherdoost, 2021:p.10). This can be done through different types of data and different collection approaches. In interpretative, qualitative research, the data collected answers the "how and why" questions and mostly covers data concerning perceptions, feelings and emotions using unstructured methods such as

semi-structured interviews. The first step in data collection is deciding what kind of data is needed, and then choosing a sample size from a particular population. The collected data is then analysed following a certain method for the purpose of drawing conclusion. Details of both primary and secondary data that was collected is provided below together with information on the data analysis process.

3.3.1 Primary Data

Primary data can be defined as data that is original and has been collected for the very first time (Mazhar et al., 2021). This study used semi-structured interviews and observations as the tools to collect the primary data.

3.3.1.1. Semi-structured interviews

Qualitative interviews rely almost exclusively on open-ended questions, which allows the researcher to ask a similar set of questions for all the participants, and the participants can answer in their own words (Babbie, 2013). Semi-structured interviews are conducted based on a guideline of predetermined open-ended questions, if the researcher needs additional data, they can continue the conversation based on the question asked before. This allows the researcher to obtain clear, comparable, and reliable qualitative data in the first meeting. The conducting of qualitative interviews is iterative, meaning each time the researcher repeats the process of collecting information, analysing it, and sorting it, they become more familiar with the study (Babbie, 2013).

In this study there were two semi-structured interviews schedules, one for parents living in the community including the community leader who is also a parent and another for educators of schools that children attended. Both the semi-structured interview schedules comprised of three sections which took between 10 to 15 minutes to complete. Section 1 included background details of the participants but did not identify participants. Section 2 captured the water supply challenges within the school/ community and Section 3 captured the impacts of water shortages on children's health

and education. These semi-structured interviews took place at the water source or the parents' home and at the school, where the researcher was also able to observe how children experience their daily life with water shortages within the community and at the school. Twenty (20) semi-structured interviews were conducted with participants who are parents and four (4) participants who were educators. Refer to Appendix 1 and Appendix 2 for a copy of the interview schedules.

3.3.1.2. Observations

Observation is another form of data collection which is commonly used in studies relating to social sciences (Mazhar, et al., 2021). Observations were used as a means of collecting primary data in this study. Igwenagu (2016) stated that the observation method can be done in two ways, the first method is observations which are done by letting the observed person know that she or he is being observed. The second method is disguised observation, where observation is made without people knowing that they are being observed (Igwenagu, 2016). This study followed the disguised scheduled observations which were conducted both at the community and school, using an observation schedule (See Appendix 3 and Appendix 4).

The observation schedule was used to observe the state of water infrastructure both at the schools and at the settlement, how children collect water at home, how and where children access water at school and the community and the distance they travel to go to collect water. The observation, specifically for the community, was done in the afternoon when children were back from school. The researcher did the observation concurrently with the afternoon interviews. The observation aspects and findings were captured on the observation schedule sheet. Pictures were captured while doing interview rounds to give the researcher a better picture of the environment in which the phenomenon takes place but the faces of children were hidden to protect their identity.

3.3.2 Secondary data

Secondary data is data that has been collected by someone before and has passed through the analysis procedure (Mazhar, et al., 2021). When using secondary data, the researcher has to recognise the various sources from where the data has been obtained. This study used journals articles, municipality reports and press statements and database found in both hardcopy and online as secondary sources of data. This form of secondary data provided assistance in putting together the background of Waterworks informal settlement and backing-up or supporting the data obtained from the primary data sources. One of the key sources used was a report by Mervyn Cirola in 2023, who highlighted the water service challenges faced by the residents of Waterworks informal settlement.

3.3.3 Sampling procedure, sample size and selection of research participants

When conducting research, it is difficult to collect data from the entire population due to time and resources, therefore following a sampling procedure to select the sample size from the population is important (Taherdoost, 2021). For this research, a portion of the population were sampled within the community and the schools around the community. A purposive sampling technique was used to select the participants with the belief that they would be able to yield the richest data. Purposive sampling is a sampling procedure in which participants are selected deliberately to provide significant data that cannot be obtained from other participants (Taherdoost, 2016). A sample of parents who live with their children within the community were sampled with the assumption that the data obtained would be representative of the existing situation that children face within the community. Educators from neighbourhood schools that most of the children attended within the community were also sampled.

The primary purpose was to select parents who stay with their children and educators from neighbourhood schools. Twenty parents and four educators from two different schools participated -two educators from Zuurbekom Intermediate Primary school and two educators from Protea Glen High School. The above schools were selected based

on data from the interviews, they were the most common schools that children in Waterworks informal settlement attended.

The identification and informing of participants about the study was facilitated through a community leader, who introduced the researcher to the community and also recommended some of the parents who met the criteria and were willing to participate. The parents were engaged at the water source in the community (water tankers) or their homes. While for the educators, an appointment was made with the school principal to visit the school. The community leader was also interviewed but as a parent and not as her role as community leader. No pilot study was deemed necessary.

3.3.4 Data analysis

After data collection, the data must be interpreted, analyzed, and presented, so that it can be clear, understood and presented as information. According to Du Ploy- Cilliers et al., (2014) the processes that needs to be used for data analysis and interpretation are systematic and rigorous to allow a detailed description of the findings of the research. Du Plooy-Cilliers, et al., (2014) have classified qualitative analysis methods as a process of reducing, organizing, interpreting, and validating data. There are many ways of analyzing qualitative data, for this research qualitative content analysis was used. Qualitative content analysis *"is used as a method to analyze text, it is employed for both the content of text and all transcribed data"* (Du Plooy-Cilliers, et al., 2014:p.233). It includes the systematic analysis of social artifacts to provide an in-depth understanding of all the raw data from the social reality reflected in the texts and all other transcribed data (Du Plooy-Cilliers, et al., 2014:). The advantages of content analysis are that it is affordable, also saves time, it does not require a large research staff and no special equipment is needed (Babbie, 2013).

Qualitative content analysis can be conducted either inductively or deductively (Du Plooy-Cilliers, et al., 2014). This research focused on a deductive qualitative content approach. A deductive approach allows the researcher to use a conceptual or theoretical framework derived from the general theories, by creating concepts from existing theories or previous studies before data analysis in order to get better

understanding of the study (Du Plooy-Cilliers, et al., 2014). The data collected was analysed based on thematic data analysis in which themes were identified, which were derived from literature review and theoretical framework. The interviews were captured into a datasheet which was coded and several specific codes were identified within the text which were broken down into several specific themes (Du Plooy-Cilliers, et al., 2014). The researcher then manually identified similar, and different patterns from the interview sheet, and grouped them into sub-themes. No independent coder was utilized. The sub-themes that emerged from the data were hygiene, running water, unreliable water sources, clean water, vandalism, diarrhoea or stomach aches and smell of the water. The literature review and theoretical framework was used to confirm the practical findings.

3.4 Data validity, reliability and trustworthiness

In qualitative research different approaches that communicate a variety of common elements are represented, focusing on people's beliefs, experiences, and expressing systems from their point of view (Golafshani, 2003). Patton (2001) as cited in (Golafshani, 2003:p.601). states that *"validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analyzing results and judging the quality of the study"*. According to Golafshani (2003), some qualitative researchers have argued that the terms validity and reliability are irrelevant to qualitative research, but they consider using the term trustworthiness to describe validity and reliability.

Trustworthiness "is divided into credibility, transferability, dependability, and confirmability" (Du Plooy-Cilliers, et al., 2014). Credibility refers to the accuracy of interpreting the data that is collected from the participants. To enhanced credibility, two research method (semi-structured interviews and observation) were used to collect data and more time was spent at the settlement during data collection in order to understand the children's lives in the settlement. Transferability is when the findings and analysis can be applied to a similar condition and deliver similar findings (Du Plooy-Cilliers, et al., 2014). Dependability focuses on the quality of the process of

incorporation of data collection method, data analysis, and the literature of the data. Confirmability was achieved through detailing the research process fully from data collection, findings and analysis in order to assist other researchers to come to similar conclusions as the researcher did.

To validate this research, the structuring of semi-structured interviews was done in a way that required less technical knowledge. This allowed all the participants to fully participate, and raise their views and opinions with regards to the impact of water shortages on their children's education and health. To validate the study, only participants from the Waterworks informal settlements and the educators from schools that the learners attended were interviewed as they shared the same background. The interview questions were written in English. During the interview, the researcher actually read out and translated the interview questions thoroughly to the participants to ensure that everyone understood the questions in their preferred language which was Sesotho. Translation was undertaken personally by the researcher as the researcher is familiar with the Sesotho language. No back translation was undertaken.

To ensure that the collected data is reliable, the following factors were considered:

- Data collection cost, the budget was allocated.
- The practicality of the data collection method, arrangement was made with community leader.
- Minimizing errors and biases, one participant was interviewed at a time and notes were taken during answering of all interview questions.

3.5 Limitations of the research

There appear to be limited studies that have been conducted on Waterworks informal settlement. One of the studies conducted is a report by Cirota (2023), titled 'lack of basic services'. The report has very limited information about the settlement. The other research report conducted by Nkoane (2019), titled "Understanding Informal Settlements in South Africa: The Waterworks Informal Settlement Profile and

Responses" also has limited data relevant to the study. To overcome this limitation of data, the study relied on the collected primary data from semi-structured interviews and observations.

Another potential limitation was the time and availability of participants for an interview. To deal with this potential limitation, a date and time was arranged through the school principal to interview educators from the schools. With the community participants, the community leader assisted and introduced the researcher to different parents who were available and willing to participate. Each participant who participated signed an informed consent form which introduced the purpose of the research.

At the school, one of the challenges was time constraints as educators had to attend to their classes. Taking of pictures at Protea Glen high school was also a challenge as the principal was not available to give permission, when follow-ups were made, the principal could not be reached.

3.6 Ethical Considerations

The study has followed both procedural and practice ethics when collecting the data. The procedural ethics involved seeking approval from the ethics committee of the IIE. Ethical clearance was granted to the researcher on 23 October 2023 (Ethical Clearance Ref: M. 821023, see Appendix 6). Ethics in practice guided the researcher in terms of how to relate with participants when conducting semi-structured interviews during field work. The community leader approved the access to conduct research at the community and the necessary consent and voluntary participation were obtained. Details of how ethical considerations such as consent, voluntary participation and data storage, have been applied are discussed in the subsections below.

3.6.1 Consent forms

The participants were issued with a consent form which introduced the purpose of the research. It also explained the rights of participants, which included voluntary participation, and the right to withdraw at any given time, as well as elements of confidentiality and anonymity. Before each interview began, the researcher explained the purpose of the research and read the consent form to the participants who were willing to participate and they signed the form (Appendix 5). However, some participants did not feel comfortable to sign the consent form, but they were willing to participate and only granted consent verbally. Most participants did not want to be recorded and so no recordings were done during the interviews. Although the study was about the effects of water shortages within the informal settlement, the interviews were directed to the parents and educators instead of children as they pose a high ethical risk in research.

3.6.2 Voluntary participation

During the interviews, the researcher was mindful that the participants might be uncertain about the questions being asked. As a result, the researcher was accompanied by a community leader who assisted with identification of parents who were willing to participate. It was explained that participating in the interview was voluntary and they have the right to withdraw from the interview at any given time. The participants were also informed that this was not an intervention study whereby the community would expect some benefits or changes. However, the outcome of the study can be made available to the participants.

3.6.3 Confidentiality and anonymity

To ensure confidentiality and anonymity, the names of the participants were never recorded in the study. Participants were referred to as parent 1-20 or educator 21-24.

They were also informed in the consent form that their confidentiality and anonymity were guaranteed.

3.6.4 Observations and photography

Photographs taken during the observations only focused on water supply, the condition of water infrastructure in the community and schools and how children are impacted by water shortages at home and school, which was detailed in the observation schedule. Faces of children were hidden to protect their identity. No recordings were done during the observations.

3.6.5 Data storage

It is important to manage the primary data collected effectively during research studies. Proper data storage saves the researcher a lot of time in finding relevant data and relieves the frustration of not losing or not finding the data, it is also a very important ethical consideration. When storing data, it is important to ensure security for the protection and availability of data to authorized users and protect it against unauthorized users (Golafshani, 2003).

Completed semi-structured interviews schedules and findings from the observation schedule sheets were kept in a secure place and were backed up. The data was secured at the researcher's home, with backup storage which include convenient working devices such as the laptop computer, and USB with password protection. Copies of completed semi-structured interviews schedules and findings from observation schedule sheets were also uploaded to Google Drive. The data storage in terms IIE MSA regulations requires data to be stored within the Department for at least five (5) years.

3.7 Conclusion

This chapter has outlined the research design and methodology used to gather evidence for this study. The main purpose of this study was exploring the effects of water shortages on children's education and health at Waterworks informal settlement. This was accomplished through semi-structured interviews and a structured observation schedule. Overall, twenty parents and four educators were interviewed. Research was undertaken in line with all necessary ethical considerations and the necessary voluntary consent was obtained by all participants. Thematic analysis was utilized following a deductive qualitative content analysis approach based on the HRBA theoretical framework which was described in the previous chapter. The next chapter details the findings of the study.

CHAPTER FOUR: RESEARCH FINDINGS

This chapter introduces the reader to some of the background context of the study area which is the Waterworks informal settlement. Background information on the two specific schools utilised in the study, Zuurbekom Intermediate Primary school and Protea Glen High school are also provided.

The chapter then provides evidence related to the two main objectives of the study which are:

- **Objective 1:** To investigate how water shortages affect children's health and education.
- **Objective 2:** To investigate how parents and educators deal with the challenges associated with water shortages affecting their children.

As part of this, the demographic information collected is presented. The findings are then holistically presented around specific themes and data obtained from interviews with the parents, community leader and educators as well as the structured observation schedule are discussed together. Photographic evidence and quotations from participants are provided throughout the chapter.

4.1 Waterworks informal settlement background

Waterworks is an informal settlement located in the south of Johannesburg, near Lenasia in the Gauteng province, South Africa (See Figure 3). It is situated on the border of the Rand West City Local Municipality and Protea Glen, which falls under Region D of the City of Johannesburg Metropolitan Municipality (Rand West City Local Municipality, 2020). Therefore, this means that one section of Waterworks falls under Rand West City Local Municipality (ward number 17), and the other section falls under the City of Johannesburg. This research was specifically conducted in Ward 17. The researcher depended on the community leader for the demarcations as there was no

formal documentation for the demarcations. Ward 17 was chosen primarily because it was the first ward that was occupied the other section is the new extension as a result of municipality plans to relocate Waterworks residents to another subsidy housing development. This proposed relocation has resulted in extensive growth of the community (Nkoane, 2019).

The plot of land on which the Waterworks informal settlement is situated has been reserved for a proposed development since 2017, which includes wholesale areas, an industrial business park, commercial hubs, and a solar farm to service the existing surrounding residential and proposed industrial business park (Nkoane, 2019). A Randwater underground pipeline passes through this land as does an abandoned and inoperative railway line located along the outskirts of Waterworks community.

A study conducted by Nkoane (2019) indicated that the reason for the existence of this settlement is due to its proximity of the busy intersection of the N12 National Freeway and the R558. Figures 3 below is a map of the Waterworks informal settlement which is at the edge of Rand West City Local Municipality. The site is adjacent to Protea Glen, which falls under Region D of the City of Johannesburg Metropolitan Municipality.

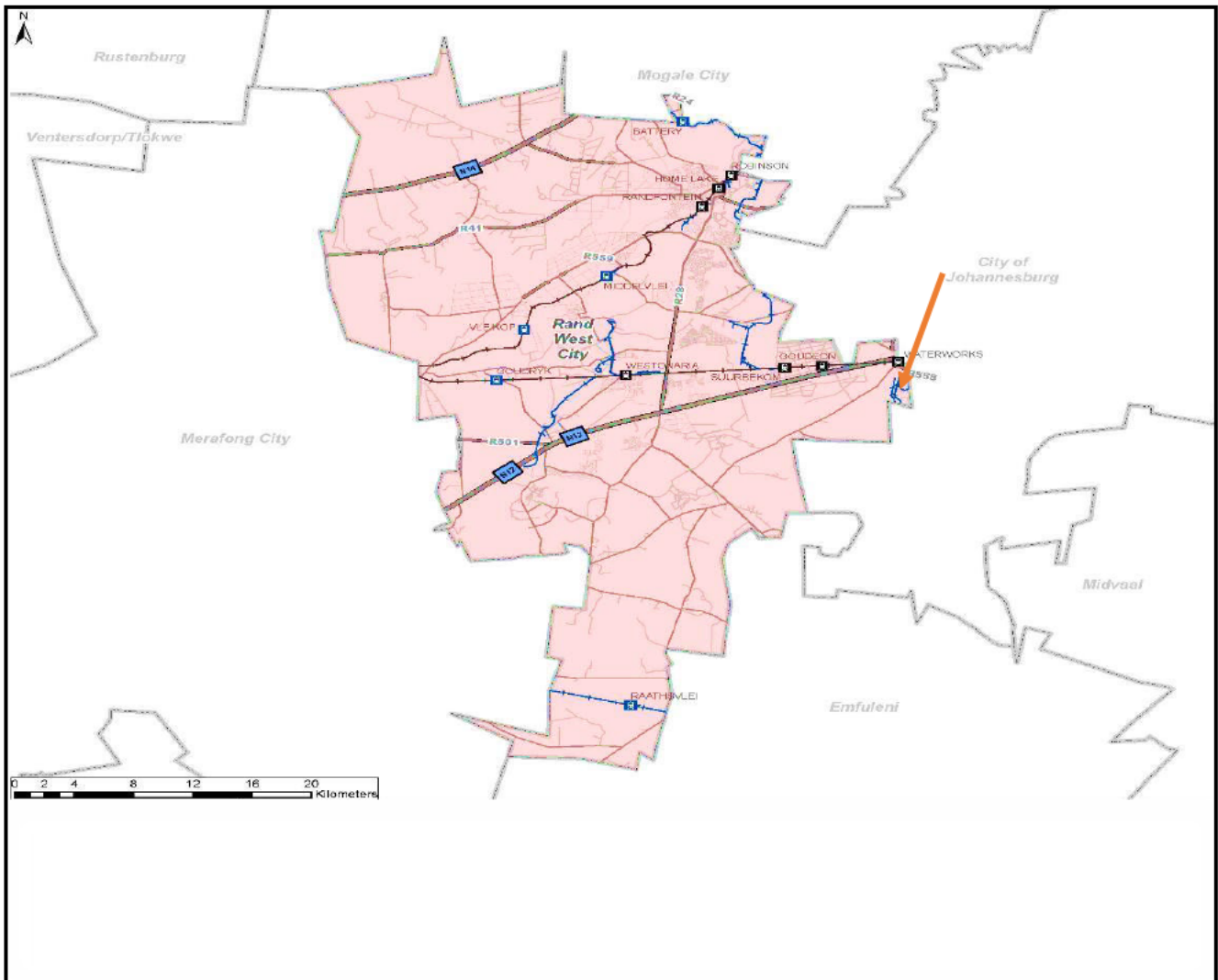


Figure 3: Location map of Waterworks (Rand West City Local Municipality, 2020)

Figure 4 below shows the boundary line of the Waterworks informal settlement. The boundary line for ward 17 couldn't be identified on the map as the researcher depended on the demarcation provided by the community leader, which was difficult to trace on the map.



Figure 4: Map of Waterworks Informal Settlement (Google Earth Map, 2024)

The Waterworks informal settlement is currently under 'supervision'. This ensures that no new shacks are established. This supervision is done by the Township Realtors SA developer in conjunction with the community of Waterworks. According to the Rand West City Local Municipality 2020/2021 Integrated Development Plan (IDP), ward 17 of Waterworks has +/- 714 households (Rand West City Local Municipality, 2020). The report conducted by the Human Settlements Portfolio Committee indicates that this community has an estimated population of 3,232, with 54% comprising of females and 46% males. In addition, 54% of the households in the community are headed by females (Cirota, 2023). The predominant languages spoken in the community are Sesotho, followed by IsiZulu and other languages.

4.2 Housing topology

The Waterworks informal settlement housing structures are mostly shacks. Many of these shacks are not in good condition, built out of tin and zinc tiles and patched with plastic to close the holes. As in many informal settlements, shacks are built close to

each other, and the streets are so narrow that cars are not able to access them. The community leader (pers comm, 2024) indicated that they are not allowed to build permanent structures as they were promised to be moved to the RDP housing project, which will be built on legal land that the municipality has acquired. Figure 5 below shows the housing structures in Waterworks.



Figure 5: Houses layout (Researcher,2024)

4.3 Access to healthcare

According to the community leader (pers comm, 2024), there are no health facilities in Waterworks. However, a mobile clinic comes every Friday to the community to offer services. The closest clinic is in Lenasia extension 2, which is far from the community. The clinic is around 10km from the community; however, the community use the short cut walking route. One of the participants who is a community leader indicated that it takes around 30 minutes to get to the clinic (pers comm, 2024). She indicated that some people go to other clinics, such as the Protea glen area or Westonaria, to seek medical attention, which is costly in terms of transport.

4.4 Data presentation

The following section of the chapter covers the findings obtained from Waterworks informal settlement as well as Zuurbekom Intermediate Primary School and Protea Glen Secondary School. The research findings were obtained from semi structured interviews conducted with 20 participants, which included the parents and a community leader who is also a parent in the Waterworks informal settlement. These research findings have been organised as themes.

Four semi structured interviews were also undertaken with educators at two schools: Zuurbekom Intermediate Primary School and Protea Glen Secondary School and have been used together with the findings from the semi structured interviews with parents in the settlement.

Structured personal observations were also undertaken in addition to semi structured interviews. In terms of these observations, the researcher was able to better understand and capture the context within which people interact and live. It also gave the researcher a clearer picture of the how things take place within the community. The observations in the study were captured by the researcher by writing notes and taking pictures while in the field. A structured observation schedule was used. The findings from the observations have been integrated into the themes below to support evidence from the parents, community leader and educators.

4.4.1 Demographic characteristics of the participants

Seventy percent of the participants that participated in the study were female. The high number of female participants aligns to the overall community demographic profile as there are more women than men. This could also be due to the fact that, in most cases, males are the providers for their families. Therefore, they wake up early in the morning for work; those not working also leave early to go hunt for job opportunities; and most of the females/ partners stay at home looking after children and doing house chores. During one of the field observations conducted in the morning, it was also observed

that most of the people who were leaving their houses in the morning for work were males. Figure 6 below reflects the gender profile of the participants at the community.

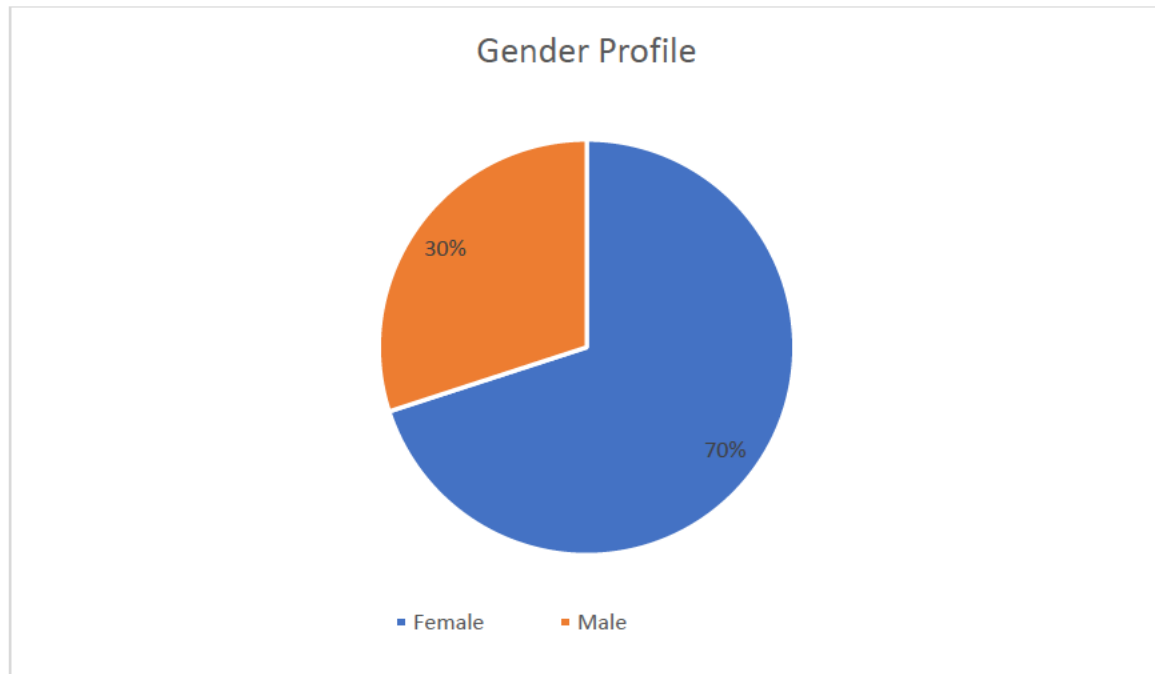


Figure 6: Gender Profile of Participants

From the semi-structured interviews and the researcher's observation, the age group of the children living within the community is primarily younger children (with 29 of the 41 children observed or 71% below the age of 12). This can be as a result of most households living in a one- or two-room shack, which has limited space and forces parents to leave their older children to stay with extended family members at their place of origin, such as rural areas. This was one of the parent responses when I asked her, how many children is she staying with? The parent responded that *"I am only staying with my youngest daughter, and my older son stays with his aunt because of space and because he is closer to school while staying at the aunts' houses"*. Figure 7 below reflects the age range profile of the children who live within the community.

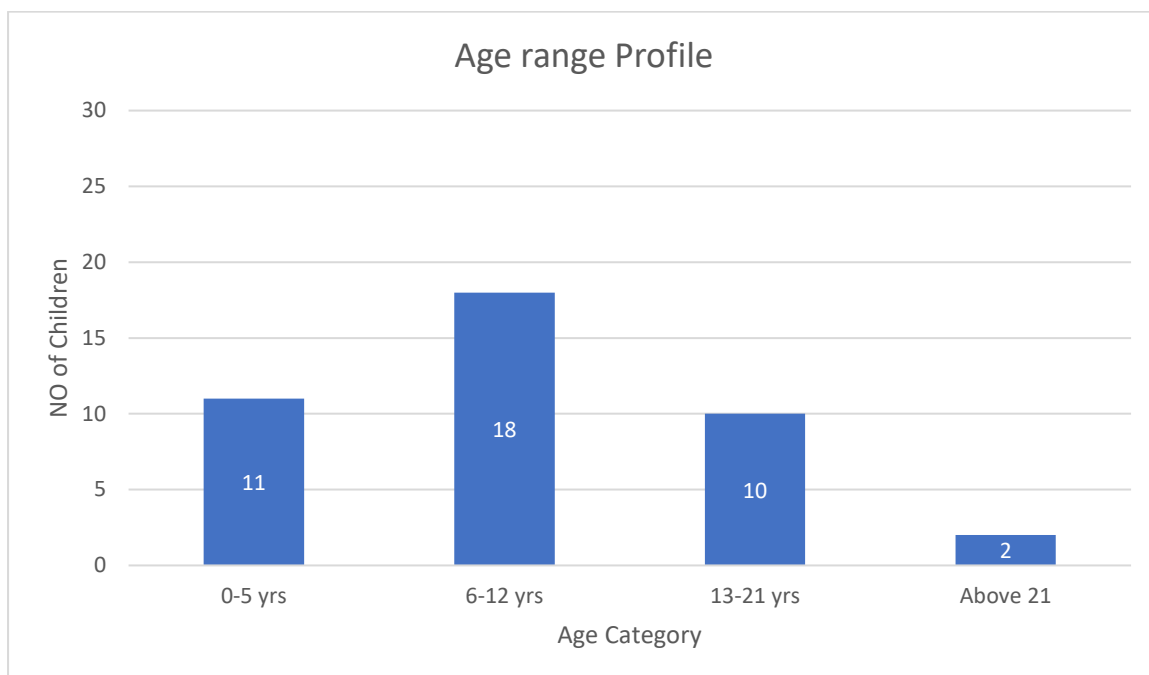


Figure 7: Age range Profile of Children

4.4.2 Employment status of participants

Table 1 below indicates the employment status of the 20 parents who participated in the study. The parents had to indicate whether they were employed full-time, part-time, self-employed, or unemployed. One hundred percent of parents responded to this question. As indicated in the table, the largest percentage (40%) of parents were unemployed. In terms of unemployment, the majority of them were female parents, contributing to 35% of the unemployed parents. 35% of the parents were doing part-time jobs, only 5% were self-employed, and 20% had full-time jobs. During the field observation, most of the parents indicated that the part-time jobs they do include housekeeping jobs, garden service and piece-jobs from the contractors who normally come to certain areas to pick up people whenever they need them, which are not guaranteed jobs. One of the common businesses that they engage in is opening a corner market or tuck shop, although some of them are owned by foreigners. They sell commodities such as bread, cool drinks, and other things.

Table 1: Employment Status of Parents

Employment Status	Female	Male	Total	Percentage
Unemployed	7	1	8	40
Part time	5	2	7	35
Self-employed	1	-	1	5
Full time	1	3	4	20
Total	14	6	20	100

The findings above highlight that most of the female parents in this study area are unemployed or doing part-time jobs, and this confirms that most of the people staying at the informal settlement are unemployed people who hope to find work opportunities around the urban areas and cannot afford accommodation in township areas.

4.4.3 Educational background

The Waterworks informal settlement has no school facilities as it was established illegally, hence the government cannot supply any school infrastructure. Children within the Waterworks informal settlement attend different schools in nearby townships. The Gauteng Department of Education has arranged for some subsidised school buses to pick up learners and drop them off at different schools nearby. The community leader (pers comm, 2024) explained that *“the school buses are always overloaded and, in most cases, they come late to collect children, which results in children getting to school late”*. The children also arrive home late as the buses transport them from different informal settlements. This was also witnessed during one of the visits conducted by the researcher in the afternoon, one of the buses dropped children off from both primary and secondary schools at around 16:10pm. The bus was still full of other children going to different informal settlements around Soweto.

Some of the primary schools nearby are; Zuurbekom primary school, Protea Glen Secondary school and Gazankulu primary school. Zuurbekom Primary School is the most popular primary school that most of the children within the community attend.

experience continuous low water pressure, which has been the norm since last year (2023). The low water pressure has resulted in some of the sanitation facilities, especially those located on the first floor, becoming dysfunctional, which makes it difficult for learners as they have to share the few sanitation facilities that are still functional (see figures 11a and 11b). Figure 12 highlights a dysfunctional toilet for Grade 1 learners, where learners have to use a bucket to flush. In the rare event where there is no water at the school, school takes a half-day since the school cannot function without water, which is used for sanitation facilities, cooking, drinking, and practicing hygiene. *“This had a ripple effect on education as the children got left behind with their education,”* said the educator (participant 21).



Figure 9: Zuurbekom Intermediate Primary School (Researcher, 2024)



Figure 10a and 10b: Water tanks used for rain water harvesting (Researcher, 2024)

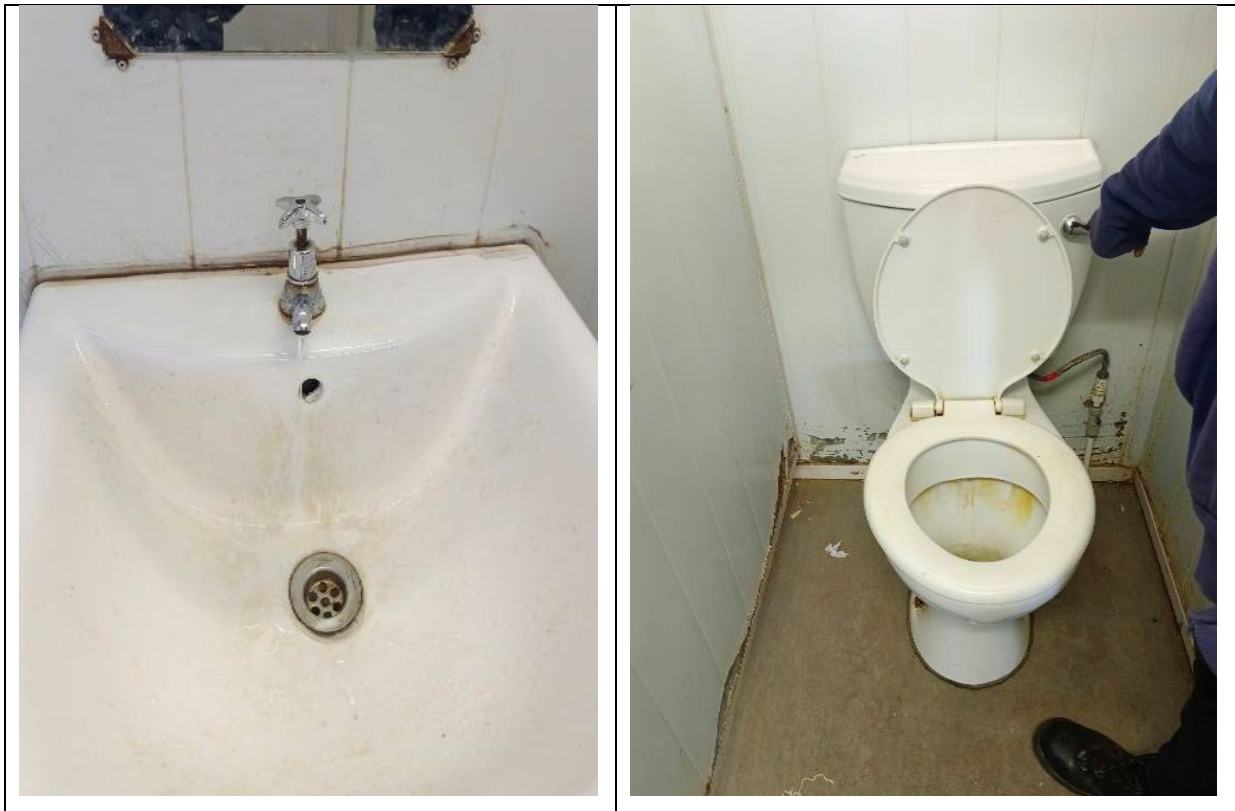


Figure 11a and 11b: Low water pressure in taps and a dysfunctional toilet due to low pressure (Researcher, 2024)



Figure 12: Bucket used to flush grade 1 toilets due to low pressure (Researcher, 2024)

Protea Glen Secondary School (see Figures 13a and 13b below) is situated at Protea Glen (Soweto) under the City of Johannesburg Metropolitan Municipality. The school is +/- 6 km from the Waterworks informal settlement (see Figure 8). The school gets its running water from the City of Johannesburg Metropolitan Municipality pipeline system. The school does not have any other alternative water sources. The educator (participant 23) indicated that the school hardly experiences water shortages unless there is a serious water disruption around Johannesburg or the Soweto area. She further indicated that if there is no water, classes are dismissed and learners are sent home.



Figure 13a and 13b: Protea Glen Secondary School (Researcher, 2024)

4.4.4 Educator's profile

Four educators were interviewed. One male educator from Zuurbekom Intermediate Primary and three female educators, one from Zuurbekom Intermediate Primary and two from Protea Glen Secondary (see Table 2).

Table 2: Gender profile of educators

Gender Profile	Protea Glen Secondary	Zuurbekom Intermediate Primary
Male	0	1
Female	2	1

4.4.5 The extent of water supply in the community

The extent of water supply in this informal settlement was investigated through two main questions, namely: type of water source and the frequency of water supply.

4.4.5.1 Access to water

Participants were asked to identify the source of water in the community, and all participants agreed that they get water from the water storage tanks. Almost all the parents indicated that the water from the water storage tanks is being supplied by Johannesburg Water, although a few of the parents, including the community leader, indicated that since the community falls under two municipalities, which are the City of Johannesburg and Rand West City Local Municipality, they both deliver water. The community leader indicated that the Rand West City Local Municipality water truck is not branded, whereas the City of Johannesburg truck is branded as Johannesburg Water; therefore, most community members think it's only Johannesburg Water that supplies water. The figure below (Figure 14) shows an employee of Johannesburg Water filling up one of the water storages tanks with water.



Figure 14: JHB water filling water tank 1(Researcher, 2024)

Linked to access to water supply, it was important to understand both the location of the water tanks as well as the distance travelled to collect water. In terms of the former, it was noted by the researcher that the water tanks are situated on the main streets,

as the other streets are too narrow for trucks and cars to access. This was confirmed by the semi-structured interviews with only five of the parents accessing water close to their houses (100m or less). The majority of participants noted that they had to travel between 200m and 800m to access water at the tanks. Two parents had to travel approximately one kilometre to the closest water tank.

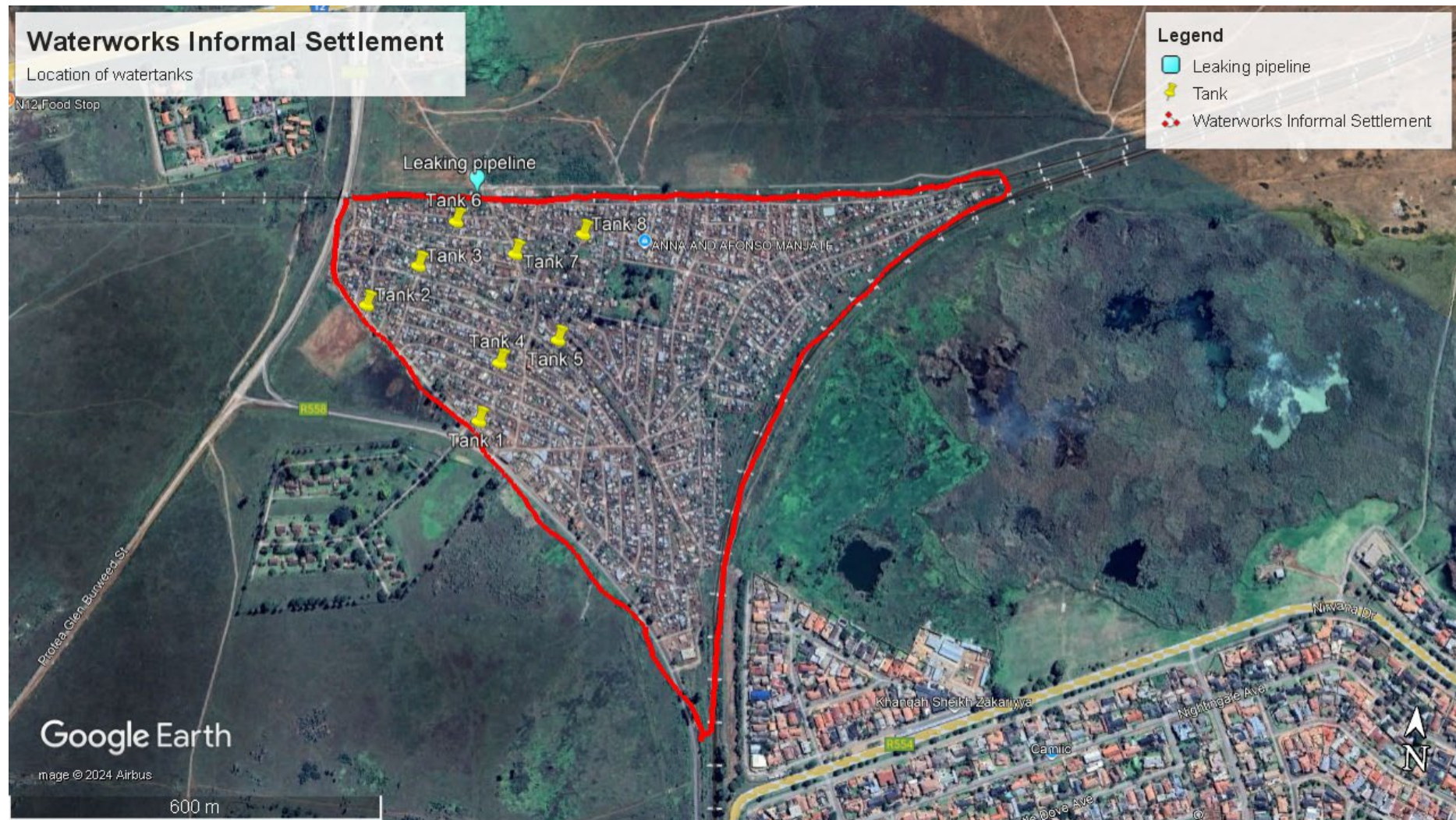


Figure 15: The location of water tanks and leaking pipeline (Google Earth Map)

Another aspect was the condition of the water storage tanks and potential challenges with the water from the tanks. The main outcome on the condition of the water storage tanks was the positioning of the tanks, cleaning of tanks, opening on the top of the tank (no top lid), stealing of taps, muddy ground next to the tank tap, and damaging of tanks by lifting them in order to get access to the remaining little water in the tanks. Parent 3 said *“some of the taps of the tanks don’t close properly and is also muddy around the tanks”*. Some parents indicated that some of the tanks are positioned in a lower position (figure 16a), making it difficult to fill a 25-liter bucket. They have to use a small bucket, which takes time. During the field observations, one of the observations was that the tank was sitting at an angle. The community leader indicated that it was as a result of people trying to get the little water that was left inside the tank out of the tank. The tanks are easy to lift if there is no water or little water because they are not bolted to the concrete stand. Refer to photographs in Figure 16a and 16b.



Figure 16a and 16b: Tank 8 sitting on low position. Source: Researcher (2024) and Lifted tank 7. Source: Researcher (2024)

Parent 20 indicated that *“They don’t clean the tanks and some tanks have no lids on top which affect the quality of water. We also have problem with tanks that are on low position, it become difficult to fill a 25liter bucket”*. Parent 7 agreed *“some tanks are always opened on top and people throw things inside”*. From my own research, the purpose of the blank top lid on water storage tanks is to prevent sunlight from entering

the tank. If the top lid is removed, it can encourage the growth of algae inside the tank affecting the quality of the water (JoJo, 2021). One of the parents, Parent 8, indicated that the missing lids are due to vandalism, and it results in people throwing things inside the tanks. (*“not sure if it is children or adults”*) (Figure 17a).

“People steal the taps even in townships; especially drug addicts, they steal for the exchange of money at the scrap yard,” says parent 12. This normally happens at night, and if there is water in the tank, it results in wasting water. Figure 17b shows an example of one such tank that has been stolen in the community. It also shows a good example of a water tank platform which was constructed to accommodate the water tank to allow easy access to the water (before it was stolen). One parent, Parent 20 who stayed close to the water tank expressed frustration with the muddy ground, which also affected his yard. He said, *“There is no drainage system next to the tap, which results in muddy ground around the tank and at the back of my shack, which causes mosquitoes.”*



Figure 17a and 17b: Tank 7 with no top lid. Source: Researcher (2024) and Tank 3 (Stolen tank). Source: Researcher (2024)

4.4.5.2 Frequency of Supply

Another complaint was the number of water tanks in the community, which they believe are not enough for the community population as the water finishes quickly and they have to spend more time collecting the water. The question around the frequency of water supply, was to find out if there was a specific day and time for the supplier to deliver or fill up the water tanks. All parents said the water truck doesn't have a specific day and time to deliver the water. Parent 15 said in particular: "*No time schedule, the trucks come anytime at the morning or afternoon and sometimes on public holidays or weekends*". Therefore, there is no specific frequency of water supply.

4.4.6 Water shortages

In order to understand the effect of current status of access to water and frequency of supply, parents were asked if they thought they experienced water shortages and 100% of them agreed that water shortages were a challenge in the community. One of the questions posed to the parents was the number of days that they often go without water. The responses to this question ranged from a minimum of 2 days to a maximum of 5 days (Refer to Figure 18). Many parents stated that it is difficult to manage their households because of water shortages or unreliable water since most household chores and preparing food require water. This affects their households since they can only do so much without water. Searching for water and collecting it requires resources, energy, and time, which becomes problematic for both unemployed and employed parents. One of the parents, who is a community leader, referred to a disabled individual living in one of the households with her children. When there are water shortages, it is difficult for the disabled individual to walk to the different tanks and look for water if the children are at school. The participants also emphasized that fetching water is both a time-consuming and exhausting process for children and even for adults who are not disabled.

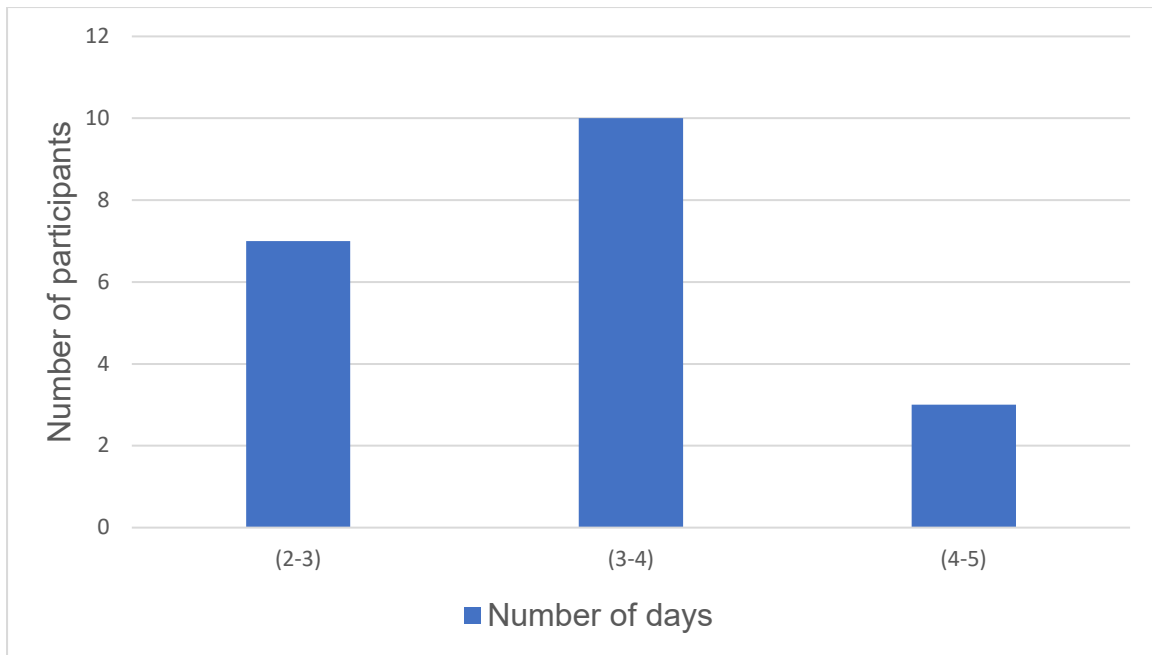


Figure 18: Number of days without water

4.4.7 Coping with water shortages

The parents and educators were also asked about how they deal with the problem of water shortages. This question was aligned with the second objective of the study, which sought to assess how parents and educators deal with the challenges associated with water shortages affecting their children. Because the water tanks do not seem to be satisfying the needs of the whole community, the community members of Waterworks have adopted some of their own strategies in order to deal with the challenges associated with water shortages that also affect their children. The strategies adopted by some of the parents are outlined and discussed below. Many of their strategies are not safe, sustainable, or reliable.

4.4.7.1 Collecting water from leaking pipeline.

The parents of the Waterworks community have created alternative ways to access water, such as taking advantage of the leaking underground pipeline that passes next to their community. The pipeline passes through the open land, which is next to the east boundary line of the community (See Figure 15). The community leader identified

the pipeline as a Randwater pipeline and indicated that the leak has been reported, but repair has been a challenge since community members go and tamper with the pipeline when there is no water. The water from the leaking pipe has created a small well where the community collects the water (see figure 19a and figure 19b below), and the overflow water from the well creates a small pond with reeds around it. Figure 20b shows the water from the small pond, which appears brownish in colour. Community members use small containers to fill the buckets, and it is a common spot where they wash their laundry on weekends. Parent 20 who stays closer to the pipeline indicated that *“When there is no water, we get water from the leaking pipeline, water looks clean although is from the ground”*. He also indicated that he doesn’t wish the leak to be repaired because he is used to this water and will suffer more with a water shortage.

The community leader (pers comm 2024) also indicated that if you’re staying far from the pipeline, it is difficult and tiring to transport the water home, as the road is too uneven to use the wheelbarrow. You have to carry the bucket or the drum on your head or with your hands. Another parent 15 stated that *“on weekends I go and do laundry at the leaking pipeline to save water, my children also bath there while I am doing laundry”*. Figure 120a provides the evidence that people do their laundry at this place. Apart from doing laundry and bathing, people from the community also dispose of their waste on this open land next to the leaking pipeline, which has the potential of affecting the quality of the water.



Figure 19a and 19b: Underground leaking pipeline Source: Researcher (2024)



Figure 20a and 20b: Evidence that people do their laundry at the leaking pipeline. Source: Researcher (2024) and Pond with polluted water. Source. Researcher (2024).

4.4.7.2 Storing water in a big drum

Storing water in big drums is another common strategy used in most areas where they encounter water shortages. However, this strategy has limits for most households in this community due to a shortage of space and storage containers. They use water from the water storage tanks to fill in their drums or containers, and they also harvest rainwater whenever there is rain. With the designs of the shack, one can conclude that even during heavy rain, one cannot collect much water as the shacks do not have gutters for water collection; they depend on the dripping water from the roof, which

does not collect much water. One parent indicated that whenever she has time, she fills her 100-liter drum with water, including all the containers she has, and her children also assist. She indicated that it is difficult for her children to fill all the containers during the week because it is tiring and time-consuming for them and they need to do their homework. Figure 21a, 21b and 21c below shows the kind of water storage containers and transporting method used by most of the children.



Figure 21: Water storage containers and transporting method (Researcher, 2024)

4.4.7.3 Buy water or asking from neighbourhood township

Some of the parents in the community have resorted to traveling to their work with plastic bottles so that they can come back with water from their work place. Parent 9 pointed out that

“If there is no water, I bring water from my employer (5 litre bottle) for cooking and drinking”.

One parent indicated she has to walk more than 5km every day from work with a 2 litre of water so that her toddler can have water for drinking. *“I work at Lenasia and every day I ask my boss to fill up my 2-litre bottle for my toddler to have drinking water. I also encourage my older daughter to fill up her water bottle at school”.* Parent 18.

Only two parents indicated that when they have money, they prefer to buy water for drinking. Parent 5 said *“I store water with buckets or go buy water at the nearby garage when I have money”*. The community leader (participant 19) indicated that *“when there is no water, there is a bakkie that comes with water, and they sell a 25-liter refill of water for R10”*.

4.4.7.4 School as a coping strategy

Some of the parents emphasized that most of the schools around the neighbourhood relieve their children from water shortages, as children are able to have water for drinking and practice hygiene at school during the day. The community leader who is also a parent (parent 19) said *“school is a relief for the children because they are able to drink running water and have access to proper sanitation where they can also wash their hand after use”*. In most instances, the children go to school with empty water bottles so that they can drink water at the school and also come back with their water bottle filled up with water so that they can have water to drink when they get home in case there is no water. Parent 6 indicated that her children like to come back with their water bottle filled with water from school because they said the water from school tastes better than the water from their water tanks. She said *“They complain that the water from the tanks have a bad taste and hardly drinks water, when they come from school the water bottles are filled with water so that they can drink at home”*.

Whilst, the schools do offer some support in terms of nutrition, including the normal food feeding scheme that covers all the learners at the school as well as the take-home food parcels every month for all disadvantaged learners regardless of where they come from, there is no formal drinking water assistance or programmes in place. Informally, one of the educators (participant 22) from Zuurbekom Intermediate Primary School indicated that *“some learners especially older learners do fill their water bottle after school especially on hot days”*. Participant 23 from Protea Glen Secondary School indicated that there are no abnormal activities that she is aware of, that learners practice as a result of water shortages at home. *“Learners do fill their water bottles,*

but not sure if it is due to water shortage at home or they want to drink on their way home” says participant 24 from Protea Glen Secondary School. She further indicated that some of the cleaners do complain of the learners especially girls, who take a bath at the basins which is not allowed at the school.

4.4.7.5 School water shortage coping strategy

Due to continuous low water pressure at Zuurbekom Intermediate Primary school, they have adopted some of their own strategies in order to deal with the challenges associated with low water pressure that affect their learners. The strategies adopted by the school include rain water harvesting and use of bucket flush system (see figure 10a,10b and 12). Protea Glen Secondary School did not have any strategy to deal with water shortages as they indicated that they hardly experience water shortages unless there is a serious water challenges within the municipal. And in that case classes are dismissed and learners are sent home.

4.4.8 Safety

Most parents agreed that their children do collect water, and it is mostly done after school. Some parents indicated that sometimes the children have to collect water in the morning before school if they don't have water to bath. Some of the reasons given for children to collect water include: parents have been at work or are not available during the day; as children, they have to assist with the house chores, which include fetching water. One of the responses from parent 17 indicated that *“my hand is injured, so I rely on my children to collect the water. I cannot carry a 25liter bucket of water”*. Parent 7 also indicated that *“They collect water after school, sometimes before school if they don't have water to bath, they go look for water in different tanks”*. The other question that was posed to the parents was with regards to the safety of the children when collecting water. Many of the parents indicated that the water tanks are safe as they are situated along the streets, but the problem arises when there is no water from the tanks and children have to travel to the leaking pipe or nearby stream, which is not safe. One of the parents (Parent 8) indicated that *“Sometimes my children go to the*

leaking pipeline to collect water there, and it is not safe for children to go there, especially girls."

One of the parents indicated that some children, especially boys go to bath at the nearby stream if it has water. Parent 18 explained *"When I come back from work on hot days, I see children especially boys bathing at the nearby stream which is not safe"*.

During the field observation, it was also observed that most of the people fetching the water are mostly women and children as young as 7 years old. Figure 21b and 21c also shows younger children transporting the water home.



Figure 22a and 22b: Children transporting water home (Researcher, 2024)

4.4.9 Effects of water shortages on children's education

As indicated in the educational background section (Section 4.4.3), there is no school in this community. Children therefore attend nearby schools in the neighbouring townships, and these schools don't have any reported water shortages. Most of the

schools get water from the municipal pipeline, and some have water storage tanks as an alternative. Parents were asked to give their opinion on whether they think the water shortage in the community has an impact on their children's education. All of the parents believe that the shortage of water in the community does have an impact on their children's education. Further, they were asked to elaborate on their opinions. Most of the explanations were based on the time taken during water collection and how exhausting it is.

Educators at Zuurbekom Intermediate Primary School and Protea Glen High School also indicated that water shortages in the informal settlement do affects learners education, although there are some learners who are still doing well even with the water shortages issues. The educator (participant 21) of Zuurbekom Intermediate Primary School indicated that *"+/- 80% of the learners are from areas that experience water shortages including the learners around Westonaria"* Participant 23 indicated that most of the learners who drop out of school are from informal settlements and they suspect that maybe water shortage is one of the challenges although there is no research done to confirm the main reasons for dropping out. She further indicated that most of the learners who are not completing their schoolwork are learners from informal settlement and it is difficult to get their parents to go to school to discuss the learner's performance.

One aspect that seems to affect children's education is time. One parent who is a community leader explained that the school buses leave early as they collect children from different informal settlements around Soweto who go to different schools. Children have to prepare early in the morning so that the buses don't leave them. When they come back from school, which is late in the afternoon, most of them still have to go and stand in the queue to collect water, which is tiring. When they have to do to schoolwork, it is almost dark, and some parents don't have money to buy lamps or candles for their children to study at night. Washing of uniforms and bathing are also challenges; children go to school with dirty uniforms and without bathing in most cases when there is no water. Another parent said that him and his wife come home around 19:00, and he explained how water shortage affects their children. Parent 20

“When I am at work, my son, who is in grade 11, has to go and collect water and also wash dishes after school. He comes back from school around 16:00, and this affects him with his schoolwork because we don’t have electricity for him to study at night”. The community leader (participant 19) also indicated that *“Children don’t focus on their schoolwork at home due to exhaustion of traveling to school and collecting water and a lack of resources such as light at night”.*

This was also corroborated from the educators at Zuurbekom and Protea Glen. For example, some of the reasons given by the educators on how learners education is affected include:

- Not doing homework or incomplete work.
- Coming to school late.

Participant 21 indicated that *“some of the learners who come to school late will give a reason that the school bus left them because they had to go fetch the water for bathing first”.* Being late for school means they miss some of the classes and curriculum work. With the issue of doing homework or incomplete homework, participant 21 indicated that some of the learners are just not willing to do it and others have serious issues with completing homework because they had to go collect water after school, and then do some of the house chores at night and because they don’t have candles or light to do homework, they cannot complete it. Some of the learners also have no one to assist them with homework, as most of the learners in primary phase still need supervision on doing homework. Participant 24 also mentioned that some of the reasons learners give for not completing schoolwork include limited time to do school work as they have to fetch water before they study and at night, they don’t have electricity. Parents also indicated that they don’t have money to buy candles or paraffin. When there is no water in the community, parents noted that most children still go to school without bathing. However, some did mention that sometimes they don’t go to school at all. However, educators indicated that most learners do come to school even if they don’t have water, because they do get access to water, sanitation facilities and food at

school. Participant 22 indicated that only when a learner is sick that's when they don't come or if the bus left them. Participant 23, a teacher at Protea Glen High School, did also note that there are some learners who just don't want to come to school, and they will give excuses of water.

4.4.10 Effects of water shortages on children's health

With regards to health, three main aspects were identified: 1.) Water quality effects, 2.) Menstruation and 3.) Hygiene and Sanitation. In terms of the first aspect, questions regarding the quality of water from the tanks were asked of participants. Some of the responses highlighted the issue of water causing diarrhoea or stomach aches, especially in younger children. One of the parents (parent 19) who is also a community leader said, *"I resorted to boiling the water before the children can drink"*, although she indicated that she uses a paraffin stove to boil the water, and paraffin is very expensive. Some of the parents complained about the smell of the water from the tanks and explained that sometimes the water comes out with dirty things, which some of them believe is due to the opening on the top of the tanks. Parent 6 indicated that *"sometimes the water is greenish or have some brown dirty things"*. Parent 15 also said *"sometimes the water has a smell and when the tank is about to be empty the water is dirty, we have to boil the water"*. During the field observations, the researcher observed that some of the tanks had openings on top, and so people could throw things inside the tanks through those holes. Furthermore, the parents mentioned that the tanks have not been cleaned for years, which raises concern about the quality of the water inside the tanks.

This information was corroborated by the interviews with the schools. Both the educators at Zuurbekom Primary School agreed that water shortages in the informal settlement affects learners health, with Participant 22, indicating that *"running stomach and flu or running nose is common for grade 1 learners"*. Participant 24 from Protea Glen High School further indicated that they once had a case where learners from other informal settlements were experiencing running stomach although the school did not investigate the cause.

Further, in terms of menstruation: a question was mainly directed at the female parents, about how their teenage girls cope during their periods when there is no water. Only three parents responded to this question, and their responses verified that it is a difficult situation, especially during school days. One parent said, *“My daughter goes to bath at my brother's place in the neighbouring township before going to school. She has to wake up very early because she walks more than four kilometers to get to my brother's place and still walks another distance to school”*. Another parent said sometimes her daughter doesn't go to school or goes without bathing.

Aligned to this, one of the Educators at Protea Glen High School, Participant 24, also indicated that some of the reasons for girls missing school or being sent home will be due to periods or menstruation.

Lastly, a number of questions were asked regarding children's hygiene and sanitation. The participants emphasised that practicing hygiene with no running water in the household was a bit difficult especially for children. The sanitation facilities do not have any handwashing systems; they have to go use a toilet located on a nearby street and come back home to wash their hands. One of the parents indicated that this becomes difficult especially if children are playing outside. Some of the responses specified that for their children to wash their hands, they have to put a small dish or bucket with water to wash the hands before eating or after using a toilet. Another parent indicated that they reuse water for washing dishes or laundry to wash their hands in order to save the water they have. Parent 1 stated that *“It is difficult to wash hands every time before eating or using toilet. Sometimes we reuse water that we used for washing dishes”*.



Figure 23: Communal sanitation facilities (Researcher, 2024)

Both participants from Protea Glen High School indicated that water shortages in the informal settlement do affects learners hygiene because most of the learners will come to school without bathing and with dirty uniforms. Participant 24 indicated that “*bathing is one of the important aspects of hygiene and also keeps you active in class*”. She further indicated that it is difficult to teach or tell learners to practice good hygiene for better health, if they won’t be able to practice it at home due to lack of resources.

4.5 Conclusion

This chapter introduced the study area, the Waterworks Informal Settlement as well as Zuurbekom Intermediate Primary School and Protea Glen High Schools. It followed a thematic approach where findings were arranged according to themes. The findings demonstrated that the health and education of children at Waterworks informal settlement are affected by water shortages. The shortage of water in the settlement is often as a results of limited water tanks, inconsistence of water supply and vandalism of water tanks.

Children's' education was affected both at home and also at school due to shortage of water. Having to fetch water before or after school often resulted in children being late or missing school. Finding also indicated that some of the girls had to miss school during their menstruation further affecting their education.

Water shortages were found to affect children's health, often children suffered from water related illnesses related. Children's hygiene was affected due sanitation facilities without handwashing facilities at home.

Whilst parents had to find alternative water supply or measures to deal with water shortages, some of these measures had safety, health or education implications to their children. While the schools did not have any strategy to address water shortages, apart from sending children home.

The following chapter will now discuss these findings in the context of the HRBA and will focus on the five cross cutting principles which include availability, affordability, acceptability, quality and accessibility of water and the effect of this on health and education.

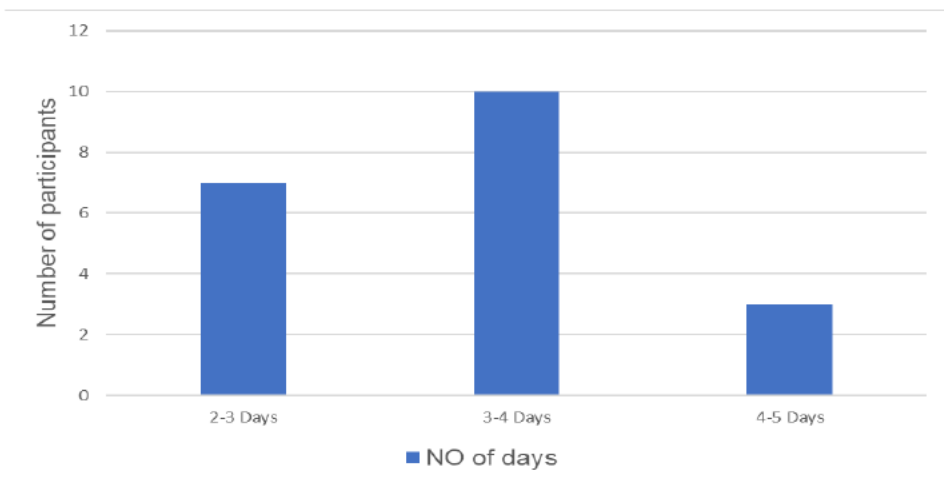
Chapter 5: Discussion of findings

5.1 Introduction

This chapter analyses the findings which were obtained from interviews with parents in the Waterworks informal settlement, educators from two schools and the researcher's own observation.

As part of this, the analysis first focused on identifying the themes that emerged from the findings. The findings were then linked to the literature review and theoretical framework in order to develop a deeper understanding of the situation with a specific focus on the Human Rights-Based Approach (HRBA) cross cutting principles (Figure 2 and Table 3).

Table 3: HRBA cross-cutting principles of water rights

	Water Shortages at Waterworks Informal Settlement	Outcomes	
		Health	Education
Availability	Participants indicated that they often spend 2 to 5 days without water (i.e. multiple times a year).	Some of the children do not bath before going to school and are not able to practice safe hygiene.	Children get to school late because they had to fetch water before school, some they miss school.
	 Figure 24: Age range Profile of Children The Water Services Act specifies that each household must not experience water access issues for more than seven full days	Participant 7 indicated that <i>It is difficult for kids to practice hygiene especially if they are playing, after using a toilet they just continue to play</i>	Participant 21 indicated that <i>some of the learners who come to school late will give a reason that the school bus left them because they had to go</i>

Water Shortages at Waterworks Informal Settlement		Outcomes	
		Health	Education
	in a year. The Universal Declaration on Human Rights does not specify how long a household should go without water, but Article 25 indicates that “<i>Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services...</i>” Although water is not included, one may argue that word “including” suggests that other necessary elements for an adequate standard of living, such as water are also included.	<i>without washing the hands”</i>	<i>fetch the water for bathing first”.</i>
Affordability	Parent 5 said “<i>I store water with buckets or go buy water at the nearby garage when I have money</i>”. The community leader (participant 19) indicated that “<i>when there is no water, there is a bakkie that comes with water, and they sell a 25-liter refill of water for R10</i>”. The Water Services Act (WSA) has introduced a free basic water policy that redresses poverty that is experienced by many South Africans. Whilst the community doesn’t formally pay for the water provided by the Municipality, due to the water shortages, they are sometimes forced to buy water.	Due to cost of buying water, hygiene is compromised in order to save water. Participant 3 indicated that “<i>because of water shortages we have to save</i>	Increased costs associated with buying of water bottles and water containers for school. Some children miss school if they don’t have water to bath.

Water Shortages at Waterworks Informal Settlement		Outcomes	
		Health	Education
		<i>water, sometimes my child doesn't bath if we don't have enough water</i> .	Participant 2 indicated that her children go to school without bathing and <i>"some days they don't go to school"</i> .
Acceptability	Some of the participants indicated that sometimes the water has brownish colour and smells. The community often prefers to use the water from the leaking Randwater Pipeline as it is perceived to be cleaner and thus more acceptable. Parent 20 who stays closer to the pipeline indicated that <i>"When there is no water, we get water from the leaking pipeline, water looks clean although is from the ground"</i>. According to SDC, (2018) water must be truly acceptable, in terms of colour, odour and taste.	Children experience Diarrhoeal diseases. Participant 11 indicated that <i>"my son has been admitted at the hospital for 3 days due to</i>	Children miss school due to illness. Participant 22 indicated that one of the common reasons of missing school include stomach related illness

	Water Shortages at Waterworks Informal Settlement	Outcomes	
		Health	Education
		<i>diarrhoea, we were told to boil water for him before drinking</i>	(running stomach).
Quality	Poor water quality in the tanks, water has a smell. Parent 20 indicated that “<i>They don’t clean the tanks and some tanks have no lids on top which affect the quality of water</i>” According to Akcaalan et al., (2022) the taste and odour (smell) of drinking water which are the aesthetic aspects of water quality have significant effects on consumer perceptions and acceptability.	Children experience Diarrhoeal diseases	Children miss school due to illness

	Water Shortages at Waterworks Informal Settlement	Outcomes	
		Health	Education
Accessibility	 Figure 25: Location of water tanks Interviews with parents showed that only five of the parents access water close to their houses (100m or less). The majority of participants noted that they had to travel between 200 and 800 meters to access water at the tanks. Two parents had to travel approximately one kilometre to the closest water tank.	This was not directly reported by the participants but heat exhaustion and dehydration could be experienced by children having to walk long distances to collect water.	Children miss school due to menstruation, miss busses to school

	Water Shortages at Waterworks Informal Settlement	Outcomes	
		Health	Education
	The Guidelines for Compulsory National Standards Regulations under Section 9 (1) of the Water services Act specifies that water should be accessed within 200 meters of a household.		

5.2 Water shortage

5.2.1 Availability

Availability refers to the availability of water required per persons per day. Sufficient water must be available continuously for personal and domestic uses, including household hygiene. From the findings, the informal settlement has access to water through water tanks. However, the water from the tanks is not sufficiently available to sustain the whole informal settlement, resulting in water shortages. When the participants were asked about the water supply in the community, they indicated that some of the factors contributing to the shortages of water include a limited number of water tanks and the inconsistency of water trucks to fill up the water tanks. According to the classification of water shortages by Manungufana (2014), this community suffers from economic water shortages as a result of poor management of water demand (no reliable supply of water) or shortage of investment in water infrastructure (water tanks).

Further, the water trucks do not have a specific schedule for delivering the water to the community; sometimes the community spends 2–5 days without a water truck delivery. This has put pressure on the availability of water as the water tanks will remain empty for days. It is a constitutional right for each individual to access sufficient water with Section 27(1)(b) of Chapter 2 stating that “*everyone has the right to have access to sufficient water and food*” (Constitution, 1996). In addition, the Water services Act specifies that each household must not experience water access issues for more than seven full days in a year. The availability of water in the Waterworks Informal Settlement, therefore, does not meet these requirements.

The Global Steering Group for Impact Investment 2022 report indicated that in 2018, one in eight of the world’s population lived in urban informal settlements, without access to basic infrastructure, such as running water or sewage. Developing countries, in particular, were mostly affected. In South Africa, 25.6% of the urban population in 2018 was living in urban informal settlements (GSG, 2022). Muzondi (2014) indicated

that informal settlements tend to experience a huge challenge with water supply, where the provision of water tends to be unsustainable with adverse effect on the standards and conditions of living therein. The Water Services Act 108 of 1997 clearly indicates that an individual is entitled to a minimum of 25 liters of water per day for direct consumption through cooking and personal hygiene (Mahlasela et al., 2020). The WHO have also indicated that 50 to 100 liters per person per day is an adequate quantity of water to meet health requirements (WWAP, 2012).

Whilst water is provided via tankers to meet this requirement, due to the unreliability of supply, this minimum is not always provided. This affects health and hygiene of children as often children are not able to bath before or after school. They also do not have the necessary access to running water to wash their hands after going to the toilet. Water-borne diseases result in a high death rate, particularly in informal urban settlements where access to safe water is limited and sanitary conditions are poor (Save the Children, 2006). This also impacts on children's education. For example, diarrhoea is one of the most common reasons why children are absent from school (UNICEF, 2012). In Waterworks Informal Settlement, some of the most common reasons for missing school include stomach related illness (running stomach).

Lack of available water also impacts on girl children at Waterworks Informal Settlement. Parents indicated that girls travel to other families to wash or miss school during their menstruation cycle. According to UNICEF (2012), shortage of water and inappropriate facilities for adolescent girls results in poor hygiene and can affect their comfort in class or result in absenteeism. The absenteeism of girls from school has a negative economic impact in the future, since educated women are most likely to raise healthy, well-nourished and educated children. Therefore, girl child should be protected from preventable infections as a result of lack of water which will stop them from acquiring important skills needed for society and economic emancipation. (UNICEF, 2012).

5.2.2 Accessibility

Accessibility, or how easy water is to obtain, is important for hygiene and health purposes. The Water Services Act (WSA) 108 of 1997 states that the accessibility of water must be “*within 200 meters of a household; and with effectiveness such that no consumer is without a supply for more than seven full days in a year*”. From the findings, it is clear that the conditions for water supply set out by legislation are not met in Waterworks informal settlements. Some of the participants still have to travel more than 200 meters to access water at the tanks. The positioning of the tanks, muddy ground next to the tank tap also affect the accessibility of the water. In addition, with no running water near toilets, children do not have a convenient water source to ensure proper hygiene which then effects health with diarrhoeal diseases being common.

The lack of accessible water, also impacts on children’s education. Parents reported that children sometimes missed the school bus or were not able to do homework as they were collecting water, suggesting that the location of the water tanks within the settlement is inaccessible.

5.2.3 Affordability

In terms of affordability, governments are required to ensure that the community can afford water services. From the findings, most of the parents in this community are not working or if working, only earn minimal wages. Forty percent of parents were unemployed, 35% were doing part-time jobs such as housekeeping jobs, garden service and piece-jobs from the contractors, only 5% were self-employed (i.e owning corner market or tuck shop) and 20% had full-time jobs. They, therefore, depend on water supplies from municipality. However, as these are not always available, some reported that they had to purchase water, making it unaffordable and not in line with the free basic water policy included in the Water Services Act (WSA) 108 of 1997. The

lack of affordability affects children, resulting in less income available to be used for other purposes such as food.

5.2.4 Acceptability

Acceptability means that water services should be provided in a way that accommodates local cultural practices, in order to be truly acceptable (Loeffen, 2021). Water must also be acceptable in terms of colour, odour and taste (SDC, 2018). Water facilities should be culturally and socially acceptable. The findings from Waterworks Informal Settlement suggests that the water from the tanks was not acceptable due to the smell and colour. For example, the older children did not feel comfortable drinking the water, they were thus likely to fill their bottles at school and only drink that water at home. This has potential implications on children's health as regular hydration is important. Further, according to Chouraqui (2023), dehydration plays a role in the development of many illnesses such as impaired mental performance of school children.

In addition, some participants often prefer alternative water sources that are perceived to be cleaner and thus more acceptable. Whilst the water is perceived to be cleaner, there are safety risks associated with this water source as it is located outside of the settlement area. In addition, people do washing in this area and the cleanliness of the water is not necessarily at an appropriate standard.

Further, the sanitation facilities were not sensitive to gender needs in terms of safety and dignity. Children have to walk to the street located toilets, which is not safe especially at night.

5.2.5 Quality

Water quality refers to the safety of water for consumption, this must be free from microorganisms, chemical substances or any other hazards that can cause a threat to human health (Loeffen, 2021). From the findings it was highlighted that the colour, odour and taste was not appropriate for personal use. Participants indicated that sometimes the water was smelly and brownish in colour. Tanks were not cleaned and often did not have lids which may also impact on the water quality. Studies suggest that storage of water in tanks may result in disinfectant deterioration of water (Salehi, 2021). Further, storage containers' materials could influence the spread of pathogens (Peter & Routledge, 2018).

Both parents and educators said that diarrhoeal diseases were common in children in the Waterworks Informal Settlement. Whilst this may be a result of poor hygiene (due to limited availability and accessibility of water), water quality may also be an important factor.

5.2.6. Cross-Cutting Principles

In summary, when looking at the five cross-cutting principles of HRBA, it can be seen that water supply in this informal settlement is not reliable in terms of **availability** (limited tanks, no schedule of water delivery 2-5 days with no water), **accessibility** (distance, the positioning of the tanks, muddy ground next to the tank tap), **acceptability** and **quality** (water has odour and was brownish in colour). Further, in terms of **affordability**, whilst free basic water is provided, due to issues with availability, people in the Waterworks Informal Settlement often resort to buying water, which has implications for affordability.

5.2.7. Water Shortages at the Schools

Findings from the two schools highlighted that water shortages at the two schools were not a common problem compared to Ward 17 of the Waterworks informal settlement.

The two schools obtained water from the municipal pipeline system. The only time these schools experienced a shortage of water was when there was municipal pipeline water interruptions. This is a positive finding in light of the fact that school is an environment where children spend a large part of their time. Having sufficient water at school, therefore, prevents learners from suffering from issues such as dehydration, which can impair their ability to focus and have long-term negative effects on their health and education (Kotingo, et al., 2014). This is particularly important in light of the importance of good education in the developing world (UN, 2022).

Despite the municipal supply, some issues were still evident at the schools. For example, at Zuurbekom Intermediate Primary School, the main issue was continued low water pressure which resulted in a reduced number of functioning toilets which has a knock on effect on hygiene and children's health.

Further, the research done by Kotingo et al., (2014) indicated that every child or member of school staff should have access to 5 litres of drinking water per school day. An additional 10 to 20 liters of water per individual should be accessible every day during school days for flushing the toilets (Kotingo, Ayerite, & Chukwuma, 2014). Whilst one of the schools had water tanks for harvesting rainwater, the water is not acceptable for human consumption, and is only used for gardening. Therefore, while it is positive that the schools have municipal water supply, municipal interruptions do result in school closing as these requirements cannot be met. This affects children's education and reduces the number of school days. According to the UNICEF & WHO 2018 report, 12% of schools worldwide had acceptable water source, but the water was not available at the time of the survey, which counted as providing unreliable water. Backup water supply is therefore important in ensuring a truly reliable supply of water at schools.

5.3 Coping with water shortages

When communities experience water shortages, parents have to implement some strategies to help their children. In Waterworks Informal Settlement, parents of children have adopted their own strategies in order to access water during shortages. These strategies include fetching water from the passing leaking pipeline, storing water in big drums, buying water or asking from neighbours and relying on schools as a coping strategy. In most cases, these strategies require children to assist.

Some of the participants indicated that they adopted a strategy of water harvesting and storage whenever water is available using large containers. Many water consumers in most areas use in-house storage water tanks for backup to mitigate the impact during times of low water pressure or interruptions especially in summer (Salehi, 2021). However, prolonged water storage can compromise water quality resulting in illness (Singh et al., 2022), which may negatively affect children's health and education. Salehi (2021) added that chemicals leaking from plastic storage tanks and high temperatures brought on by exposure to the sun may accelerate the degradation of disinfectants in water and encourage the development of disinfectant by-products and biofilms. Thus, the materials used in storage containers may have an impact on the spread of infections like *Legionella* and *Pseudomonas*, which could have serious consequences for human health (Peter & Routledge, 2018).

An alternative method of accessing water used by the Waterworks community, is taking advantage of the leaking underground pipeline that passes next to their community boundary line. While this water source is viewed as acceptable by the community, there are both health and safety concerns for the children using this water source. According to Mustafa and Hassan (2024), surface water can be contaminated by emergent pollutants such as synthetic fertilizers, pesticides, heavy metals, personal care products, detergents, and other substances, which eventually have an impact on human health. Children need to have access to clean water, so that their health is protected from water related diseases.

Another strategy employed is buying water or asking from neighbours. Further, the schools also implemented their own strategies which included rain water harvesting and use of bucket flush system. However, as the schools had a more reliable source of supply, the need for and number of adopted strategies was not as high as the Waterworks community itself. In fact, some parents felt that school itself act as a relief to their children as they are able to get access to water and sanitation while at school.

5.4 Safety

Safety is a practice that eliminates or protect one from danger, risk, or injury (Nas, 2015). The human right to water also addresses access to safe and affordable water regardless of ability to pay. One of the criteria of accessibility is safety, where water source should be safe especially for needs of vulnerable groups including persons with disabilities and children (Loeffen, 2021). Children of Waterworks informal settlement have to leave their houses to fetch water and to use sanitation facilities which exposes them to danger. In cases whereby there is no water from the tanks children have to assist their parents' with fetching the water from the leaking pipeline, which is located at the isolated space. When children have to access the community sanitation facilities especially at the night, they have to walk which pose risk to physical attacks and sexual violence. During the researcher's observation, the inconvenient and unsafe position of communal sanitation facilities perpetuates the risks children and the community face. There is no electricity or lighting around the sanitation facilities which poses a significant safety concern for children and the community as a whole.

5.5 Effect of water shortages on children's education

All the participants believe that the shortage of water does have an impact on children's education. Most of the explanations by the parents were based on the time taken during water collection and how exhausting it is. Challenges of accessing the water were highlighted. Children have to walk long distances or queue to access water,

which is exhausting and time-consuming. This limits children's time to do their schoolwork, and time to relax or rest. Convenient access to a safe water source in or near the home reduces the burden on children, especially girls, and allows time to be spent on other household or relaxation activities (Singh et al., 2022).

Children miss school during water shortages due to a various reason such as sickness from water-related diseases, helping with family chores, sanitation and hygiene issues (Save the Children, 2006). Educators also highlighted the issue of untidy learners, absenteeism, limited time for learning and poor performance. These issues relate to water shortages. For example, children are untidy because they have to go to school without bathing, which can reduce participation in class or result in poor concentration. One of the educators indicated that some children choose not to go to school if there is no water, this also affects girls during menstruation which increases the amount of absenteeism at schools. The importance of menstruation is reflected in SDG target 6.2, which aims to achieve adequate and equitable sanitation and hygiene for all, paying attention to the specific needs of women and girls (UNICEF & WHO, 2018).

In the rare incident where there is no water at the school due to a serious water disruption on the municipal pipeline systems, classes are dismissed, which deprives children from receiving a proper education or falling behind with their syllabus. One of the schools has water tanks for harvesting rainwater, but the water is not fit for human consumption, and they only use the water for gardening. If there is no water at school, classes are suspended or shortened, which reduces time for learning as children will not have water for sanitation facilities, drinking, and a feeding scheme to prepare food for the learners. A study conducted by IPEC (2012), shows that the impact of water shortages negatively affects educational outcomes for children. In addition, Drozdowska et al., (2020) found that when a school environment has sufficient water, it supports learners in adequate water intake, resulting in better mental performance.

Further, according to research undertaken by Dlamini (2017), water shortages can cause learners to suffer from hunger due to a shortage of water for cooking, they might have to stay in a dirty environment because there is no water for cleaning; and it also revealed that learners could encounter syllabus challenges since some subjects, such as social science and agriculture, require water for practical assessments.

5.6 Effect of water shortages on children's health

It is evident that water is critical to the health of the children living in the informal settlement. Some of the themes that emerged from the findings relate to health and hygiene issues. The water provided from the water tankers is not reliable in terms of quality with findings showing that the water tanks have not been cleaned or maintained, and some tanks do not have closing lids. This affects the health of the children at the Waterworks informal settlement. Health issues such as diarrhoea has affected the children.

In addition, the condition of sanitation facilities in this informal settlement may also result in poor hygiene practice, since there are no handwashing facilities where children can wash their hands after use. Practicing good hygiene without running water or enough water is a challenge, which compromises health. Shortages of water, therefore, exposes children to various waterborne diseases (Wright, et al., 2023).

According to Singh et al., (2022), children's right to housing is fully realized with the provision of basic services, such as access to drinking water both within the home and within the community at large. In this case, children often have to spend a maximum of 5 days without water. They also do not have accessible or available water supply which may result in dehydration. Dehydration may result in illnesses that compromises the health of the children.

5.7 Conclusion

This chapter focuses on discussing the findings presented in Chapter 4 in the context of the HRBA and the associated effects on health and education on children in the Waterworks Informal Settlement.

In particular, the findings showed that demonstrated that water shortages were an issue in the community of Waterworks informal settlement often as a result of poor maintenance of water tanks and insufficient and inconsistent water supply. As a result, children were affected by all five cross cutting principles which include availability, affordability, acceptability, quality and accessibility. Children's health and education was subsequently also affected by these water shortages. Children's hygiene was affected at home by water shortages and often children suffered from illnesses related to water quality. Having to fetch water before school often resulted in children being late or missing school and girls often had to miss school during their menstruation further affecting their education.

Chapter 6 provides the conclusion based on the findings presented in Chapter 4 as well as the discussion of the findings in Chapter 5. It also provides a number of recommendations as well as opportunities for future research.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Access to basic services such as water is crucial for everyone, especially children. Most of the basic services such as sanitation, health and education rely on water to function properly. This study has highlighted the effects of water shortages on children in the Waterworks informal settlement and the related effects in terms of children's education and health. This chapter summarises the main findings from the research process and provides insights into the main research questions of this study which were:

- How do water shortages in informal settlements affect children's education and health and,
- How do parents and educators deal with the challenges of water shortages in their children's education and health?

The chapter concludes with recommendations on how to address and possibly resolve the water shortages at the Waterworks informal settlement.

6.2 Summary of the findings

The purpose of this study was to explore the effects of water shortages in the Waterworks informal settlement and the effect of water shortages on children's education and health.

Two objectives were developed to address the overall purpose. The first objective of the study was to explore the effects of water shortages on education and health in children living in informal settlements. The second objective was to investigate how parents and educators deal with the challenges associated with water shortages affecting their children. The study employed a qualitative research design to achieve its purpose. Data was collected using qualitative tools such as semi-structured

interviews with a sample of parents, including the community leader, who is also a parent in the settlement of Waterworks, and educators at two common schools where most learners attend. In addition, a second data collection method was used which was direct observation by the researcher. A formal observation schedule was used and the findings of the observations were used to augment the findings obtained through the semi-structured interviews.

Waterworks Informal Settlement is an illegal occupation of the land which restricts the government's ability to supply running water to the settlement, just like many other informal settlements in South Africa. However, as access to water is a human right to every citizen, irrespective of where they stay, the government had to temporarily supply water to ensure that every citizen has access to water. This temporary water supply is in the form of water tanks installed in the community. The municipality then fills them with water. The challenge lies with the limited water tanks that are installed and the inconsistent schedule to fill the water tanks, which results in water shortages in the settlement.

In terms of the first objective, the findings revealed that the settlement constantly experiences water shortages, which affect their children's health and education. One hundred percent of the parents who participated in the study highlighted the frustrations of water shortages and how it affects their children's education and health. Children are forced to collect water before or after school from either the water tanks or the nearby leaking pipeline. This activity is time consuming and exhausting for children. Children have to spend time in the streets, queuing or searching for water, which affects their education, as they have limited time to do schoolwork. It is also a safety risk for children to walk long distances sometimes to isolated areas. The shortage of water is also uncomfortable for girls, especially during menstruation. Furthermore, another concern is the quality of water as a result of uncleaned and open water tanks, in which parents indicated that children experience running stomachs, especially in younger children, and as for the older ones they no longer have confidence in drinking the water which may result in dehydration.

Access to sanitation and hygiene facilities is another challenge faced by these children, as the sanitation facilities, which are not in good condition and located in the streets for communal sharing, do not have a water supply or handwashing facilities. This makes it difficult for children to practice good hygiene without running water and they often have to go back home to wash their hands, if there is water at home for such purposes. The use of communal facilities also compromises their safety.

The findings revealed that water availability at the two schools is much better compared to the settlement. However, there are challenges – for example, one of the schools, Zuurbekom Primary School has continuous low water pressure, which has an impact on the health and education of children. The low pressure was highlighted as a concern because learners have to share a minimum number of sanitation facilities which also compromises the practice of good hygiene. The educators have highlighted that in the instances where there is no water at the school, classes are dismissed, and learners go home. This situation compromises quality education.

Both the parents and educators were of the opinion that their children's education and health were affected by the water shortage. However, because water shortages in the two schools were not as common as in the settlement, most parents express that schools were much more of a relief to their children as they were able to access drinking water at school, sanitation facilities, and were also able to practice better hygiene than at home.

Findings related to the second objective revealed some of the strategies that parents and educators implemented in order to deal with the challenges of water shortage. Some of the strategies that parents have adapted in order to cope with water shortages included storing water in big containers, asking neighbours for water buying water and collecting water from the leaking pipeline. The collection of water directly affects children; it either compromises their time for doing schoolwork as they become exhausted and tired or results in missed school days as sometimes they miss the bus to school. Literature also revealed that the storing of water in big containers can affect

the quality of the water, which can compromise children's health. The leaking pipeline which is situated in an open piece of land also exposes children to safety concerns.

Finding from the two schools shows that both schools depend on municipal water supply. In cases of water shortages, classes or learning is suspended since they don't have other alternative water source. Zuurbekom primary school has water tanks for rain harvesting, however the water is not suitable for drinking or human consumption and not connected to any sanitation facilities. They use the water from rain harvesting for gardening purposes only.

6.3 Conclusions drawn from the research

In conclusion, this research study has gathered and presented evidence that strongly suggests that water shortages in the Waterworks informal settlement have an effect on children's health and education. This challenge is not faced by Waterworks informal settlement only, it is also faced by many informal settlements in South Africa and worldwide. The main causes of water shortage in this community were; a limited number of water tanks, inconsistent water supply and vandalism of water tanks.

The first objective of the study, which was to investigate the effects of water shortages on children's health and education concluded that:

- Children have to make use of sanitation facilities without handwashing facilities at home, which promotes poor hygiene practices.
- Children spend time in the streets, queuing or searching for water before or after school, which is tiring and exhausting. This resulted in children being late or missing school.
- Lack of maintenance of the water tanks by the municipality also affects the quality of water. This results in children suffering from diarrhoeal diseases related to poor water quality. This compromised their health and decreased

their confidence in drinking water from the tanks. It also resulted in children missing school due to illness.

- The continuous low water pressure at school also compromises the health and hygiene of the learners, leading to the sharing of bathrooms.
- Water shortages often resulted in girls missing school during their menstruation which further affect their education

Conclusions drawn from the second objective of the study, which was to investigate how parents and educators deal with the challenges of water shortages in their children's education and health, included the following:

- The majority of the parents were unemployment or earned very little and depended on the municipality to provide them with water supplies. However, due to inconsistent water supply, parents had to find alternative supply which include storing water in big drums, collecting water from the leaking pipeline, and buying water or asking for water from neighbourhood township.
- The schools have no alternative water sources, they are forced to close or suspend the learning if there is no water.
- Schools did provide relief to learners when they did have water as they were able to fill up their water bottles and take water home.

6.4 Recommendations

Water is a global human right, which is protected by several human rights instruments. In South Africa, the Constitution lays the basis for the right to access sufficient water and allocates the responsibility of delivering water to the communities, to the municipalities. Several municipalities are struggling with this task leaving settlements like Waterworks with water shortages, which have direct effects on children's health and education. As a result, some recommendations have been proposed. These recommendations are targeted at parents, schools, the local municipality as well as the National Department of Water and Sanitation and Department of Human Settlements.

- 6.4.1 The municipality should consider having a schedule for filling the water tanks based on the minimum prescribed legal requirements of the Water Services Act. They should also consider increasing the number of tanks within the settlement. This will increase the availability of water.
- 6.4.2 The municipality should consider developing a maintenance schedule to ensure that water tanks are cleaned and maintained. This would ensure that the water tanks do not compromise the quality of the water.
- 6.4.3 Parents should be encouraged to form a water committee, where they can participate in proposing solutions to some of these challenges – for example the installation of affordable hand washing facilities. This committee could also ensure that water tanks are cleaned regularly and the community take care of them.
- 6.4.4 The government should consider providing sanitation facilities with taps to such settlements. This would encourage children to practice good hygiene by washing their hands after using the sanitation facilities.
- 6.4.5 Schools should consider alternative water supplies such as boreholes or rain water harvesting to supplement the flushing of toilets. These could be acquired through donations or requesting the National Department to assist. This would allow schools to remain open when there is no water and would limit the effect on children's education.
- 6.4.6 The Department of Human Settlement should accelerate the relocation and or upgrade of the Waterworks informal settlement to the RDP housing programme. This would ensure that residents have a good standard of living and allow for municipal supplied services to be delivered to the community as it would no longer be an illegal settlement.

A final recommendation is for future research on this topic. The availability of water is an important issue in South Africa as many communities' face water shortages or no water for days. Some communities are supplied with water, but the quality of the water is poor. Therefore, it is suggested that future research could investigate the quality of water supplied to the informal settlements of South Africa., particularly informal settlements that access water through water tankers and water tanks.

It is hoped that these recommendations would improve the water supply situation at Waterworks informal settlements resulting in the improved health and education of the children of this settlement.

REFERENCES

- Akcaalan, R., Devesa-Garriga, R., Dietrich, A., Steinhaus, M., Dunkel, A., Mall, V., Manganelli, M., Scardala, S., Testai, E., Codd, G.A. and Kozisek, F., 2022. Water taste and odor (T&O): Challenges, gaps and solutions from a perspective of the WaterTOP network. *Chemical Engineering Journal Advances*, 12, p.100409.
- Antwi, S.K. and Hamza, K., 2015. Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European journal of business and management*, 7(3), pp.217-225.
- Australian Institute of Health and Welfare, 2018. *Australia's health*, Australia: Canberra: AIHW
- Babbie, E., 2013. *The Practice of Social Research*. Canada: Cengage Learning.
- Chouraqui, J.P., 2023. Children's water intake and hydration: a public health issue. *Nutrition Reviews*, 81(5), pp.610-624.
- Cirota, M., 2023. *Waterworks informal settlement still awaiting formalisation, residents neglected*, Lenesia, 18 May 2023. [Online]. Available at: <https://dagauteng.org.za/2023/05/waterworks-informal-settlement-still-awaiting-formalisation-residents-neglected> [Accessed 22 February 2024].
- De Kock, N., 2021. Water supply, legislation and consumption trends in South Africa. *African Journals*, 11(12): pp.12-13. [Online Access]. https://hdl.handle.net/10520/ejc-vp_stock_v11_n12_a5 [Accessed 08 November 2023].
- Department of Basic Education, 2013. *South African Schools Act, 1996 (Act NO 84 of 1996)*. South Africa: Department of Basic Education.
- Department of Basic Education, 2021. *National Department of Basic Education Annual Report*, South Africa: Department of Basic Education.
- Department of Statistic, 2023. *Statistical Release: Census 2022 Publication No. P0301.4*, South Africa: Department of Statistic South Africa.
- Department of Statistics, 2022. *Mid-year population estimates*, Pretoria: Statistics South Africa.

- Dlamini, N.M., 2017. *Investigating the influence of water scarcity on the well being of some primary school learners in the Lubombo region of Swaziland* (Doctoral dissertation).
- Donnenfeld, Z., Hedden, S. and Crookes, C., 2018. *A delicate balance: Water scarcity in South Africa*. South Africa: The Institute for Security Studies (ISS).
- Drozdowska, A., Falkenstein, M., Jendrusch, G., Platen, P., Luecke, T., Kersting, M. and Jansen, K., 2020. Water consumption during a school day and children's short-term cognitive performance: The CogniDROP randomized intervention trial. *Nutrients*, 12(5), p.1-18.
- Du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.-M., 2014. *Research Matters*. Claremont: Juta.
- Ghasempour, A., 2015. Informal settlement; concept, challenges and intervention approaches. *Specialty journal of architecture and construction*, 1(3-2015), pp.10-16.
- Golafshani, N., 2003. Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), pp.597-607.
- GSG, 2022. Informal settlement: No Longer Invisible, s.l.: The Global Steering Group for Impact Investment.
- Guppy, L. and Anderson, K., 2017. *Water Crisis Report*, Canada: s.n.
- Gutierrez, J., 2019. *Water Scarcity and Supply Challenges in Mexico City's Informal Settlements, Mexico*: Penn Institution for Urban Research, 2.
- Hall, K., 2019. Children's access to housing. ChildGauge.
- Huber, M., Knottnerus, J.A., Green, L., Van Der Horst, H., Jadad, A.R., Kromhout, D., Leonard, B., Lorig, K., Loureiro, M.I., Van Der Meer, J.W. and Schnabel, P., 2011. *How should we define health?* *Bmj*, 343.
- Hunter, P. R., MacDonald, A. M. and Carter, R. C., 2010. Water Supply and Health. *Policy Forum*, 7(11).
- Igwenagu, C., 2016. *Fundamentals of research methodology and data collection*. Nigeria: LAP Lambert Academic Publishing.

IPEC, 2012. South Africa - The impact of water service delivery on children's livelihoods, especially on their school attendance and performance. *International Labour Organization*, Volume 1.

John-Nsa, C., 2021. *Understanding the factors influencing the spatial dynamics of informal settlements: The case of Enugu City, Nigeria*. December, Issue 79, pp. 29-43.

JoJo, 2021. *JoJo*. [Online] Available at: <https://www.jojo.co.za/water-storage-solution/> [Accessed 13 July 2024].

Kotingo , E., Ayerite , A. & Chukwuma , C., 2014. Assessment of the water facilities in primary schools in the Niger Delta. WASH education series 1.. *IOSR Journal of Dental and Medical Sciences*, 13(9), pp. 1-7.

Loeffen, A., 2021. Human Rights-Based Approach—A practical guide for the realization, through programming, of the human rights to water and sanitation. *Arribat-International Journal of Human Rights Published by CNDH Morocco*, 1(1), pp.85-99.

Maemeko, E., Mukwambo, M. & Nkengbeza, D., 2021. Social Challenges Learners Residing in Informal Settlements in Katima Mulilo Town Face in Learning. *Journal of Curriculum and Teaching*, 10(3), pp. 36-46.

Mahlasela, P., Oke, A. and Madonsela, N.S., 2020. Household's satisfaction with water supply in Johannesburg Metropolitan Municipality, South Africa. *Procedia Manufacturing*, 43, pp.183-192.

Manungufana, T. E., 2014. *Water Scarcity: Classification, Measurement and Management*. South Africa: © Springer Nature Switzerland AG.

Mazhar, S.A., Anjum, R., Anwar, A.I. and Khan, A.A., 2021. Methods of data collection: A fundamental tool of research. *Journal of Integrated Community Health* (ISSN 2319-9113), 10(1), pp.6-10.

Mirugi-Mukundi, G., 2014. *South African Human Rights Commission, 2014 - report on the Rights of Access to Sufficient Water and Sanitation*. ESR Review: Economic and Social Rights in South Africa, 15(1), p. 12.

- Morgan, G.A.R.Y., 2019. *Ideas towards water sensitive settlements*. Water Research Commission. Gezina, South Africa. Available at: https://www.wrc.org.za/wp-content/uploads/mdocs/2519_final.pdf. [Accessed 12 July 2023].
- Mustafa, B.M. and Hassan, N.E., 2024. Water Contamination and Its Effects on Human Health: A Review. *Journal of Geography, Environment and Earth Science International*, 28(1), pp.38-49.
- Muzondi, L., 2014. Sustainable water provision in informal settlements: A developmental challenge for urban South Africa. *Mediterranean Journal of Social Sciences*, 5(25), pp.102-107.
- Nas, S., 2015. The Definitions of Safety and Security. *Journal of ETA Maritime Science*, 3(2), pp. 53-54.
- Nkoane, A., 2019. *Understanding informal settlements in South Africa: The Waterworks informal settlement profile and responses*, Johannesburg: University of the Witwatersrand (Doctoral dissertation).
- Parra, J., 2012. *The human rights-based approach: a field of action for human rights education*. Cifedhop.
- Peter, A. and Routledge, E., 2018. Present-day monitoring underestimates the risk of exposure to pathogenic bacteria from cold water storage tanks. *PLoS One*, 13(4), p.e0195635.
- Prasad, C. and Gupta, P., 2020. Educational impact on the society. *International Journal of Novel Research in Education and Learning*, 7(6), pp.1-7.
- Rand West City Local Municipality, 2020. *Final Integrated Development Plan (2020/21)*, s.l.: Rand West City Local Municipality.
- RSA, 1996. *Constitution of the Republic of South Africa, no. 108 of 1996*. Government Printer, South Africa.
- SAHRC, 2000. *3rd Economic and Social Rights Report*, South Africa: South African Human Rights Commission.
- SAHRC, 2021. *Water and Sanitation Report, South Africa*: The South African Human Rights Commission.

Salehi, M., 2021. Global water shortage and potable water safety; Today's concern and tomorrow's crisis. *Environment International*, pp. 1-7.

Save the Children, 2006. The Impact on Children of Water Shortages, s.l.: Save the Children. <https://s3.savethechildren.it/public/files/uploads/pubblicazioni/impact-children-water-shortages.pdf>. [Accessed 27 July 2023].

Scanlon, J., Cassar, A. and Nemes, N., 2004. *Water as a human right?* (No. 51). IUCN, Gland, Switzerland and Cambridge, UK.

SDC, 2018. *A human rights-based approach to water and sanitation*, s.l.: Swiss Agency for Development and Cooperation.

Sileyew, K., 2019. *Research Design and Methodology. Text Mining-Analysis, Programming and Application*. Intech Open.

Singh, S. D., George, T., Ndugwa, R., Röbbel, N., Triche, R., Pritts, J. and Cargile, H., 2022. *Children, Cities and Housing: Rights and Priorities*, Atlanta: Habitat for Humanity.

STATS SA, 2018. *General Household Survey, South Africa: Statistics South Africa*.

Taherdoost, H., 2016. Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management (IJARM)*, Volume 5, pp. 18-27.

Taherdoost, H., 2021. Data Collection Methods and Tools for Research; A Step-by-Step Guide to Choose Data Collection Technique for Academic and Business Research Projects. *International Journal of Academic Research in Management (IJARM)*, 10(1), pp. 10-38.

The Department of Human Settlements, 2021. *Official guide to South Africa 2020/2021*, South Africa: The Department of Human Settlements.

Thorne, G., Carvajal, A. & Kim, W., 2021. Early Childhood Development In Urban Informal Settlements And Slums, Switzerland: Save the Children.

Township Realtors SA, 2018. *The developers of Protea Glen*, South Africa: Township Realtors SA.

UN Charter, 1945. Charter of the United Nations, San Francisco: United Nations.

- UN, 2022. *The Sustainable Development Goals Report 2022*, s.l.: United Nations.
- UN-HABITAT, 2005. *Responding to the Challenges of an Urbanizing world*, Nairobi: United Nation.
- UN-Habitat, 2017. *Situation Analysis of Informal Settlements in South Africa*, Nairobi: UN-Habitat.
- UN-Habitat, 2022. Annual Report 2022, Kenya: UN-Habita.
- UNICEF and WHO, 2020. *Progress on drinking water, sanitation and hygiene in schools: special focus on COVID-19*. World Health Organization.
- UNICEF, 2009. 2009 Annual Report, South Africa: UNICEF.
- UNICEF, 2012. *Water, sanitation and hygiene (WASH) in schools*. New York: UNICEF.
- UNICEF, 2015. *Introduction to the human rights-based approach*, Finland: UNICEF.
- UNICEF, 2021. *Urban water scarcity guidance note: preventing day zero*, Madagascar: UNICEF.
- UNRISD, 2016. *The Human Rights-Based Approach to Social Protection*, Switzerland: UNRISD.
- Doharey R.K., Verma, A., Verma, K. and Yadav, V.R., (2023). Education: Meaning, Definition & Types. Verma, *Agriculture Extension Education*, pp.1-6. [online] ResearchGate. Available at: https://www.researchgate.net/publication/372418302_Education_Meaning_definition_Types. [Accessed 08 November 2023].
- Weatherhead, J.E. and Hotez, P.J., 2015. Worm Infections in Children. *Paediatrics in review*, 36(8), pp.341-52.
- WHO, UNICEF, and World Bank, 2022. *State of the world's drinking water: an urgent call to action to accelerate progress on ensuring safe drinking water for all*. Geneva: World Health Organization.
- WHO and UNICEF, 2017. *Water, sanitation and hygiene in health care facilities: status in low- and middle-income countries and way forward.*, Switzerland: World Health Organization.

WHO, 2019. *The Right to Water*. Switzerland. World Health Organization. <https://www.who.int/publications/i/item/9789240013391> [Accessed 02 July 2023].

WHO, 2024. Diarrhoeal disease. Switzerland. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease> [Accessed 16 November 2024].

Wilkinson, M.J., Dlamini, X.L., Magagula, T.K. and Muller, H., 2019. A framework for monitoring and reporting water supply goals and targets (2016-2030): moving from the millennium goals (MDGs) to Sustainable Development Goals (SDGs).

WWAP, 2012. The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk, Paris, France: UNESCO.

Wright, C.Y., Kapwata, T., Cook, C., Howard, S.J., Makaula, H., Merkley, R., Mshudulu, M., Tshetu, N., Naidoo, N., Scerif, G. and Draper, C.E., 2023. Inadequate Access to Potable Water Impacts Early Childhood Development in Low-Income Areas in Cape Town, South Africa. *Annals of Global Health*, 89(1).

Zubaidi, S.L., Ortega-Martorell, S., Al-Bugharbee, H., Olier, I., Hashim, K.S., Gharghan, S.K., Kot, P. and Al-Khaddar, R., 2020. Urban water demand prediction for a city that suffers from climate change and population growth: Gauteng province case study. *Water*, 12(7), p.1-7.

APPENDICES

Appendix 1 Interview questions for parents



Notes to semi-structured interviews

My name is Phumudzo Moloto and I am studying Master of Philosophy in Integrated Water Management student under the supervision of Linda Downsborough and my co-supervisor Ms Vanessa Stippel. I am studying at IIE MSA. My research topic is "Exploring the effects of water shortages on children's education and health within Ward 17 of the Waterworks informal settlement, Gauteng Province, South Africa."

The interview questions will ask you how water shortages affect children's education and health in the Waterworks informal settlement.

There is no right or wrong answer. There will be three sections of questions. If you wish not to answer some of the questions feel free to do so. Your name or identity will not be mentioned anywhere.

I will ask you questions in either English or Sesotho whichever you are most comfortable with. During the interview no audio recording will be recorded, I will only take notes for further referral.

Interview questions for the Parents / legal guardian

Date:

Time:

Weather:

Section 1 - General information

1. Gender?

Male	
Female	

2. What is your employment status?

Unemployed	
part-time job	
Self-employed	
Full-time job	

3. How old is your child/ children?

0-5 years	
6-12 years	
13-21 year	
More than 21 years	

4. Which School does your child/ children attend?

.....

Section 2 – Water shortages in the community

1. Do you experience water shortages in your community?

.....

2. If yes, how often do you experience water shortages?

.....

3. Where do you get water from?

.....

4. Who supplies the water?

.....

5. When does the water truck come?

.....

.....

6. Do you experience any challenges with the water from the tanks?

.....

.....

7. What is the condition of your water infrastructure?

.....

.....

8. How far is the water source from your house?

.....

9. What do you do to avoid being affected by water shortages? (Is what your alternative water source?).

.....

.....

Section 3: How do water shortages affect children's education and health?

1. Do your child/children go to collect water?

.....

2. If yes, when do they collect the water and how often?

.....

.....

3. Is the water source accessible to the children/child-friendly?

.....

.....

4. How does collection of water impact the children?

.....

.....

5. How do children prepare for school if there is no water?

.....

.....

6. How do children practice hygiene at home after using toilet or before eating?
.....
.....
7. If there are water shortages, how are female children affected when they are menstruating? (This question will be directed to female parents.)
.....
.....
8. Do you think the shortage of water have impact on your child's education?
.....
9. If yes, why?
.....
.....
10. Do you think the shortage of water have impact on your child's health?
.....
11. If yes, why?
.....
.....
12. Are there any other challenges that children face due to water shortages?
.....

Appendix 2 Interview questions for educators



Notes to semi-structured interview

My name is Phumudzo Moloto and I am studying Master of Philosophy in Integrated Water Management student under the supervision of Linda Downsborough and my co-supervisor Ms Vanessa Stippel. I am studying at IIE MSA. My research topic is “Exploring the effects of water shortages on children’s education and health within Ward 17 of the Waterworks informal settlement, Gauteng Province, South Africa.”

The interview questions will ask you how water shortages affect children’s education and health in the informal settlements.

There is no right or wrong answer. There will be three sections of questions. If you wish not to answer some of the questions feel free to do so. Your name or identity will not be mentioned anywhere.

I will ask you questions in either English or Sesotho whichever you are most comfortable with. During the interview audio recording may be recorded, I will also take notes for further referral.

Interview questions for the Educator:

Date:

Section 1 - General information

1. Gender:

Male	
Female	

2. Which grade do you teach?

.....

Section 2 – Water supply in the school

1. Where does the school get water from?

.....

2. Who supplies the water?

.....

3. Is the water source within the schoolyard?

.....

4. Do you experience water shortages in the school?

.....

5. If yes, how often? once a week or once a month? And what's the maximum days could you spend without water at the school?

.....

6. Does the school have any alternative water source, to avoid being affected by water shortages?

.....

7. If there are water shortages at school, how does this affect the learners? Are classes disrupted?

.....

.....

Section 3 – How water shortages in informal settlements affect children's education and health?

1. Is there any school support for learners who face water shortages at home? If yes, what is this support and how is it managed?

.....

.....

.....

2. Are there any activities or things that learners do at school as a result of water shortage at home? E.g take water home in bottles/containers, bath or wash uniform at school?

.....

.....

.....

3. Do you think the shortage of water in the informal settlement impact the learners?

.....

.....

4. If you had to estimate, how many of your learners have issues with access to water at home?

.....

.....

5. Do you think their education is affected by the water shortages at home?

.....

6. If yes, what are some of the reasons?

.....

.....

.....

7. Do you think their health is affected by the water shortages at home?

.....

8. If yes, what are some of the reasons?

.....

.....

9. How are they affected?

.....

.....

10. Do learners miss school because of water shortages at home? If yes, how often do you think they miss because of this?

.....

.....

11. If yes, what are some of the reasons?

.....

.....

12. If learners miss school what are the most common reasons for them missing school? E.g periods for girls, stomach related illnesses, flu?

.....

.....

13. Are there any other challenges that informal settlement learners face as a result of water shortages in their communities?

.....

.....

Appendix 3 Observation schedule at community



Observation schedule -within the community

The main purpose of observation is to observe where and how children access the water within the community. The observation will be done each time when I visit the community in order to build up an accurate reality of water access within the community.

Date:

Time:

Weather:

Observation Aspect	Comment
Do you see children collecting water?	
What types of containers do they use to collect water and how do they transport it home?	
How far are the water taps/tanks from household?	
How many water taps/tanks?	
What sanitation facilities do the community use? What condition are they in?	
Other significant aspects	

Appendix 4 Observation schedule at school



Observation schedule -at the school

The main purpose of this observation is to observe where and how children access the water at the school. The observation will be done during school hours especially during the breaks time in order to build up an accurate reality of how children access water at school.

Observation schedule -at the school

Date:

Time:

Weather:

Observation Aspect	Comment
Where do children access water at school?	
Is there evidence of water drinking fountains?	
Is there currently water at the school?	
Is there evidence of visible hand washing facilities?	
Do you observe any children with drinking water bottles to school?	
Observation of any supplementary water supply? e.g JoJo tanks, rainwater harvesting, borehole. how far away is the jojo tank?	

Is there a school feeding scheme? School kitchen?	
Are there food gardens or vegetable gardens at the school?	
Is there evidence of taps, sprinklers, irrigation around the school?	
Is there any watering of the school property taking place during my observation?	

Appendix 5 Consent form for participants



Explanatory information sheet and consent form for participants
To whom it may concern, My name is Phumudzo Moloto, and I am a student at IIE MSA. I am currently conducting research under the supervision of Linda Downsborough and my co-supervisor Ms Vanessa Stippel, Exploring the effects of water shortages on children's education and health within Ward 17 of the Waterworks informal settlement, Gauteng Province, South Africa. I hope that this research will enhance our understanding of how water shortage influence children's education and health. I would like to invite you to take part in my study. To explain to you what your participation in my study will involve, this information sheet will try to answer some of your questions so that you can make an informed decision about whether or not you participate. If you have any questions that you feel are not addressed or explained in this information sheet, please do not hesitate to ask me for more information. I will read and explain all the information contained in this sheet and once you have understood all the information and willing to take part, please complete and sign the consent form below.
What will I be doing if I participate in your study?
If you decide to take part in this research, the information that you will provide will help to better understand the impact of water shortages on children's' education and health. You can decide whether to take part in this research. If you decide to participate, you can choose to withdraw at any time or to decide not to answer particular interview questions.
Are there any risks/ or discomforts involved in participating in this study?
One of the discomforts might be some of the participants not willing to participate. The participants will be notified that the participation is voluntary and they will not be forced to take part in the study. Emphasis will be made clear that the study is only for academic purposes and nothing else to avoid any other expectations and feeling betrayed. Other discomfort is that some participants may not understand English, therefore the interview will be conducted in their home language and translated back to English. Other risk might be participants who don't want the interview to be conducted in their homes, hence the second location which is a public location of water source point has been identified.
Do I have to participate in the study?
• Your inclusion in this study is completely voluntary. • If you do not wish to participate in this study, you have every right not to do so. • Even if you agree to take part in this study, you may withdraw at any time without having to provide an explanation for the decision.
Will my identity be protected?

I will not reveal your identity. I will not use your name in any research summaries to come out of this research and I will also make sure that any other details are disguised so that nobody will be able to identify you. Nobody else, including anybody at the IIE MSA, will have access to your interview information. I would like to use quotes when I discuss the findings of the research, but I will not use any recognisable information in these quotes that can be linked to you.

What will happen to the information that participants provide?

Once I have finished all interviews, I will write summaries to be included in my research report, which is a requirement to complete my Masters of philosophy in water management. You may ask me to send you a summary of the research if you are interested in the outcome of the study.

What happens if I have more questions about the study?

Please feel free to contact me or my supervisor should you have any questions or concerns about this research, or if there is anything you need to know before you decide whether or not to participate.

You should not agree to take part unless you are completely comfortable with the procedures followed.

My contact details are as follows:

Phumudzo Deborah Moloto

[REDACTED]
[REDACTED]

The contact details of my supervisor are as follows:

Linda Downsborough

[REDACTED]
[REDACTED]

Appendix 6 Ethical clearance letter



Our Ref: M. 821023
Enquiries: research@iie.ac.za

23 October 2023

Outcome of Ethics Clearance Application for Master of Philosophy in Integrated Water Management

Student Name: Phumudzo Deborah Moloto
Student number: [REDACTED]
Brand and campus: IIE/ISA

Dear Phumudzo,

Thank you for submitting the ethics clearance application for the study:
Exploring the impact of water shortages on children's education and health within the Waterworks informal settlement in the Gauteng Province, South Africa.

We are pleased to inform you that the IIE's Higher Degrees Committee considered and granted ethics clearance. This means that you may proceed with data collection on condition that you reflect and implement the changes proposed by the IIE Higher Degrees Committee to the satisfaction of your supervisor. If you are collecting data from a specific organisation, ensure that you have a gatekeeper's letter that confirms their approval of the data collection being done.

You are reminded that any changes made to the research methodology or title of the research study must be resubmitted to the IIE's Higher Degrees Committee for approval. Kindly ensure that all ethical considerations are duly applied whilst collecting, analysing and interpreting the data for the completion of your research.

If you have any questions, please feel free to contact your programme team or supervisor directly.

All the best with your research.



Dr WH Engelbrecht
Chair: Higher Degrees Committee

ADvTECH House: Inanda Greens, 54 Wierda Rd West, Wierda Valley 2196
P.O. Box 2369, Randburg 2125
Directors: RJ Douglas (UK), JDR Oesch, MD Aitken, SCD Lurie
Group Company Secretary: CB Crouse



The Independent Institute of Education (Pty) Ltd is registered with the Department of Higher Education and Training as a private education institution under the Higher Education Act, 1997 (reg. no. 2007/HE07/002). Company registration number: 1987/004754/07.

