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School of Geography, Archaeology and Environmental Studies
Department of Geography and Environmental Studies

MSc Research Thesis

The effects of water scarcity on rural livelihoods: A case study of Borakalalo village in Lehurutshe (North West Province).

By

Lydia Tabane (335140)

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DECLARATION

I, Lydia Tabane, declare that this thesis, submitted in fulfilment of a Master of Science degree in Geography and Environmental Studies at the University of Witwatersrand, is my own independent work. I have not previously submitted work contained in this thesis for a qualification at any other university or faculty, neither do I intend to do so in future.

Lydia Tabane

Johannesburg, 2015

Signature_____

DEDICATION

This is going to be long and unconventional. It's my opportunity to thank so many important people in my life, so if you are reading this, I should probably politely request that you bear with me.

It gives me great pleasure to firstly dedicate this thesis to Jesus Christ, through whom all things are possible. I would like to make use of this opportunity to thank my parents for their unwavering love and support. I am truly grateful to have parents that are crazy enough to dream with me. Thank you for consistently nagging me about my academic work for as long as I can remember. I thank my siblings, my two brothers whom I love dearly, for the laughter and love that fuels me.

An African child has an entire village as her family and, I am truly grateful for my family. I thank my uncle Malome Kennedy for driving me around and taking me wherever I needed to be with a smile on his face. I also thank his wife Sthatha for her love and kindness. I thank my cousin Thami for showing me around the village, and waking up with me every morning for field work. Even on Monday mornings when he was extremely hangover due to excessive partying and drinking over the weekend. I thank my aunt Mmabakwena for her smile, my uncle Dugmore for his jokes and my aunt Pinkey for her madness. All these little things mean the world to me and, on bad days I am motivated by the love I know you all have for me. I have so many amazing cousins that I love as much as I know they love me. I thank them all for the joy they bring to my life, even though I can't name them all. There are just so many of you incredible cousins of mine. I especially thank my cousin Latoya Keebine for giving me this amazing research idea. My remaining grandparent, Mmamputsu, her only wish is to live long enough to see her grandchildren succeed. I ask God to grant your beautiful soul its one request, may you live long enough to see each and every one of your grandchildren become spectacular.

I am truly thankful to everyone in Borakalalo village who opened their doors and hearts to me. Thank you for not getting impatient with the extremely long survey questions. I thank you all for your words of encouragement. Most importantly, I must express gratitude for the tea and biscuits served to me with love.

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There is a special lady that has been like a mother to me for the last couple of years. She goes by the name of Marji Snelling, and to her I will forever be indebted. I just want to thank you for believing in me and my capabilities, for investing in me and expecting nothing in return. It's clear to see that with me you went beyond your call of duty. You truly are an angel and you deserve all the love and happiness in the universe. I also thank Greg Morse for teaching me valuable lessons, for refining me as a professional, an academic and a human being. Another thing, thank you for teaching me fancy English words that make me sound cleverer than I actually am. I am just so eternally grateful to the whole Setpoint team for believing in a clumsy and shy rural girl like me.

I'd like to take this opportunity to remember important people who are no longer with me in the physical realm, but nonetheless, memories of them are forever inspiring me to be the best possible version of myself. I remember my late grandfather Rrapat who always encouraged me to study and instilled a love for education in me. I remember my grandmother, after whom I am named and, from whom I have learned to genuinely laugh. I remember my cousin Jomo, I thank him for teaching me how to be a clown. I have

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Thank you all.

All my love,

Lydia Ikgopoleng Tabane (Lolita).

"For I know the plans I have for you, declares the LORD, plans to prosper you and not to harm you, plans to give you hope and a future." (Jeremiah 29:11).

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LIST OF ABREVIATIONS

Agricultural usage (AU)

Basic Human Need and Reserve (BHNR)

Business Usage (BU)

Department of Environmental Affairs (DEA)

Department of Water Affairs and Forestry (DWAF)

Food and Agriculture Organization of the United Nations (FAO)

Integrated Development Plan (IDP)

Livestock usage (LU)

Ramotshere Moila Local municipality (RMLM)

RSA (Republic of South Africa)

Small Enterprise Development Agency (SEDA)

Soweto (South Western Townships)

Statistics South Africa (Stats SA)

Water Shortage (WS)

World Health Organisation (WHO)

ABSTRACT

The aim of this thesis is to expose the effects of water scarcity on rural livelihoods. The chosen study site for this investigation is Borakalalo village in Lehurutshe region (North West Province). The aim of this study was to explore the water usage patterns of households in Borakalalo village in order to unpack the various water-related activities that households in Borakalalo engage with. The main argument made in this thesis is that in order to comprehend the effects of water scarcity on rural livelihoods, it is paramount that the water usage trends of rural dwellers be documented and, the contribution made by various water-related activities in generating a livelihood income be scrutinised. Therefore, using the sustainable rural livelihood framework of analysis, the goal of this study was to investigate the role that water plays in securing a livelihood for households in Borakalalo village.

The introduction chapter explains the relevance of this study in the context of South Africa as a whole, also paying special attention to Borakalalo village, which is the chosen study site for this investigation. The methodology chapter highlights the advantages and disadvantages of methodological techniques employed in this study. A critical engagement with literature on water scarcity reveals some of the key conceptual dilemmas in defining water scarcity. Furthermore, the social, political and economic impacts of water scarcity on a global and national scale are looked into. A household survey that was conducted with 150 households in Borakalalo village aimed to uncover the water usage trends of rural households and, to examine how water serves the livelihoods of households in Borakalalo village. In the discussion chapter some of the main findings in this investigation are brought forth through looking at the ways in which water-related activities such as agriculture, livestock herding and small water-related rural enterprises sustain rural livelihoods.

Although the discussion uncovers the role of water in a productivist rural economy, the results also seem to suggest that there is a shift in the rural economy from productivist to post-productivist livelihood activities. Henceforth, as much as water scarcity poses a threat to productivist livelihood activities, it also limits the expansion of the emerging post-productivist rural livelihoods. Furthermore, the increased need for monetary income in rural households in order to compensate for the loss of productive rural activities is evident.

However, high levels of unemployment in rural areas limit the capacity of rural households to generate monetary income, and henceforth, livelihoods in Borakalalo village are enormously threatened by current water shortages in the village.

Chapter one: Introduction

1. Background to study

Availability and access to freshwater is a crucial indicator for economic growth and social development. However, the twenty first century is considered to be the era of water scarcity by many scholars (McCaffrey, 2004; Pittock & Lankford, 2010; Postel, 2000; Seckler *et al.*, 1999). Some of the factors exacerbating water scarcity are: climate change, population growth, the degradation of water resources and rapid economic development. In addition, the uneven distribution of water in society is also a major contributor to water scarcity. The effects of water scarcity are evident in most regions of the world such as East Africa, the Middle East, North Africa, Northern Coast of South America and some parts of the Caribbean, just to name a few.

South Africa is rated as the thirtieth driest country in the world. Known for its low and variable annual rainfall patterns as well as high evaporation losses, South Africa is classified as a water scarce country, with less rainfall per capita than arid countries such as Namibia and Botswana. The global annual average rainfall is 1033mm and, only 495mm of the world's annual rain falls within South African territory. Some regions of South Africa receive less than 100mm of rain due to the uneven distribution of rainfall across the country (Hedden & Cilliers, 2014).

Water scarcity has displaced many rural communities in developing nations. Food security[1] in rural areas is threatened, there is increased competition for resources as well as increased ethnic tension and water related conflicts, all consequences of water scarcity (Reuveny, 2007). Water availability affects rural livelihood sustainability[2]due to the direct link between household access to natural resources and economic poverty in rural areas of the developing world (Matshel *et al.,* 2013). Thus in order to ensure water security in rural areas, it is paramount that one gains an understanding of the livelihood strategies of rural

[1]The agricultural sector is the most sensitive to water scarcity. Also, an increasing demand for a varied diet is observed in most parts of the world, translating into an increased demand for meat and dairy products. Such factors put more pressure on global water resources, and also prevent access to food for the poor due to the unavailability of water (Food and Agriculture Organization of the United Nations, 2012).

[2] Livelihood is defined as the development and implementation of strategies that ensure human survival. A livelihood comprises of the capabilities, assets (both material and social resources) and activities required for a means of living ('The International Recovery Platform' & 'The United Nations Development Programme', year unknown).

people and the role that water plays within them (Dlamini, 2007; Lonergan, 1998). It is therefore essential that attention be directed towards gaining an understanding of how water scarcity influences the livelihood options available to rural dwellers. According to Ravenga & Cassar (2002) one billion of the world's rural population still lacks adequate and reliable access to water and, it is the rural population that is most affected by water scarcity due to their direct reliance on water for livelihood purposes.

There is a lack of knowledge about the extent of livelihood opportunities that rural dwellers can engage with when they have access to sufficient water, and when access to water is limited due to water scarcity (Butterworth *et al*., 2003; Dlamini, 2007; Mokgope & Butterworth, 2001; Mokgope *et al*., 2001; Moriarty & Butterworth, 2003). In rural South Africa, the focus has often been on providing basic water needs for domestic purposes. However, Pollard *et al.,* (2002) suggest that most rural households do not only use water for domestic purposes, instead, water is also used for productive activities such as subsistence farming, livestock production and brick laying. Matshel *et al*., (2013: 138) further state that *"In the case of South Africa, an evaluation of the policy and planning framework indicated that although a basic framework for the productive use of water existed in the country, it was not sufficiently comprehensive or explicit to facilitate implementation*". More specifically, the framework fails to provide a clear water supply mandate on the provision of water for productive activities to rural households. Water increases the livelihood options available to rural households and, it is thus indisputable that in most developing countries, livelihood options that are subject to water availability (such as irrigated agriculture and livestock herding) play a crucial role in sustaining rural livelihoods.

There is a gap in knowledge about the function of water in sustaining rural livelihoods. In other words, the various livelihood activities that rural dwellers utilise water for are often not fully realised. In addition, the Basic Human Need and Reserve (BHNR) that was enacted to the 1998 National Water Act serves as evidence of the current dearth in understanding about rural water usage. The aim of the BHNR was to ensure the allocation of basic human water need to all and, to introduce the concept of a reserve (both human reserve and ecological reserve). The BHNR relies heavily on the standards set by the free basic water policy of 2000 that makes 6000 litres of water per household per month an entitlement (Dlamini, 2007; DWAF, 2001; Perret, 2002). Nonetheless, there are questions around

whether or not the BHNR is suitable for meeting the water needs, both domestic and productive water needs, of rural dwellers. Scholars such as Pollard *et al*., (2002) argue that the BHNR is a reflection of a lack of understanding about rural water needs and the various livelihood activities that villagers engage with. There is little known about rural water usage patterns, and thus, a number of problems have been identified with the BHNR and its attempt to meet the water needs of rural households. The main theoretical claim made by Pollard *et al*., (2002:4) is that *"...current discussions around rural water supply needs tend to assume that the BHNR once implemented will be enough to meet them. This ignores actual and potential role of water in (small scale) productive activities."* In addition to the BHNR, basic water supply in South Africa is further defined as 25 litres per person per day. The water should be accessible within 200 metres of the home and should be of acceptable quality (Matshel *et al*., 2013). Yet Naidoo *et al.,* (2009) question the adequacy of the basic water supply parameters in meeting rural water needs. It is thus evident that the range of activities that rural households use water for and, the contribution made by water-related activities in sustaining rural households, is an area requiring research (Van Koppen, 2003).

1.1. Thematic consideration

The intention of this research is to contribute to the current body of knowledge on rural water usage, through scrutinising ways in which water influences the livelihood options available to households within Borakalalo village in Lehurutshe district. The main aim was to explore the range of water-dependent/water-related activities that households in the chosen study site engage with, and to probe how those activities sustain the livelihoods of households in Borakalalo village. The degree to which water-dependent activities sustain households in Borakalalo village is another area of exploration, in other words, this research was also concerned with investigating whether or not rural households are able to generate a livelihood through other income generating activities that are not water-related. Overall, this research exposes water-related activities that are threatened by water scarcity, unveils how threatened activities contribute to sustaining the livelihoods of households in Borakalalo village, and finally, the capacity of households in Borakalalo village to generate an income independently from water-related activities is also scrutinised (Butterworth *et al*., 2003; Dlamini, 2007; Mokgope & Butterworth, 2001; Mokgope *et al*., 2001; Moriarty & Butterworth, 2003).

1.1.1. Background information on water provision in Borakalalo village

Lehurutshe in the North West province of South Africa and its surrounding villages (Borakalalo being one of the surrounding villages) falls under the Ramotshere Moila Local Municipality (RMLM). The Ramotshere Moila Local municipality then falls under the Ngaka Modiri Molema District Municipality. Lehurutshe also forms part of the former "Bantustan" (homeland) of Bophuthatswana (Jones, 2010; Ngaka Modiri Molema District Municipality, 2008; Ngaka Modiri Molema District Municipality *& Ramotshere Moila Local Municipality*, 2011).

A substantial percentage of households under RMLM do not have access to piped water and sanitation (*Ramotshere Moila Local Municipality IDP document*, 2013). In 2011 some 65.3% of households under RMLM either accessed water through community stands or in-dwelling taps. Approximately 21.3%[3] of households depend on boreholes as a source of water. Other sources include: spring water, utilised by about 0.3%[4] of households, while rain tanks provide water to about 0.1%[5] of households. Dams, pools and stagnant put together are a source of water for approximately 0.4%[6] of households. It is also estimated that about 0.6%[7] of the households under RMLM depend directly on river and stream water, and some 0.6%[8]of households receive water from water vendors. Meanwhile, water tankers provide water to 8.9%[9] of households, and about 2.2%[10] of households depend on water from other water sources not mentioned above.

[3] South Africa, 2013: *Ramotshere Moila Local Municipality Integrated Development Plan of 2013-2014,* Report no. 01-01-01, Government Printer, Mafikeng.
[4] ibid
[5]South Africa, 2013: *Ramotshere Moila Local Municipality Integrated Development Plan of 2013-2014,* Report no. 01-01-01, Government Printer, Mafikeng.
[6] ibid
[7]South Africa, 2013: *Ramotshere Moila Local Municipality Integrated Development Plan of 2013-2014,* Report no. 01-01-01, Government Printer, Mafikeng.
[8] ibid
[9]South Africa, 2013: *Ramotshere Moila Local Municipality Integrated Development Plan of 2013-2014,* Report no. 01-01-01, Government Printer, Mafikeng.
[10] ibid



Figure 1: Map of Borakalalo village.

Initial ground truthing revealed that there have been numerous occasions when residents of Borakalalo village have gone without water for long periods of time. Residents of Borakalalo have been faced with periodic water cuts from early 2010. However, a water shortage situation that began as periodic water cuts escalated into permanent/prolonged water cuts for some households in the village, especially households in upper-lying sections of the village. Households in upper-lying sections of Borakalalo have not been able to access piped water from in-dwelling or community taps from early 2012. At that point in time, what began as periodic water cuts, lasting for a few days before normal water provision recommenced, developed into prolonged water cuts that last weeks and months before normal water supply is restarted. When normal and uninterrupted water supply resumes after prolonged water cuts, supply of piped water usually only lasts for a few days or weeks, at least (1 day) and at most (2 weeks) before interruptions to piped water supply picks up once again. The local municipality has responded to prolonged water cuts in upper-lying sections of the village by strategically placing Jojo water tanks in elevated parts of Borakalalo, in this way, households that do not have access to piped water can make use of

Jojo water tanks instead. As a result, residents in upper-lying sections of the village receive water mainly from Jojo water tanks.[11]

Although a decline in the rate of population growth from 1996 to 2001 from 1.22%[12]to 0.92%[13]growth per annum is observed, also visible is a significant increase in the number of households in Lehurutshe. Consequently, an increase in the number of households in Lehurutshe has affected service delivery and has increased water demand in the region (*Ramotshere Moila Local Municipality IDP document*, 2013).

1.1.2. How this research fills the identified knowledge gap

It is evident that there is increasing difficulty in accessing water for residents of Borakalalo village. However, there is very little knowledge about how complications in accessing water have impacted the livelihoods of households in Borakalalo (Dlamini, 2007; Van Koppen, 2003).

In order to understand how challenges in accessing water have affected households in Borakalalo village, one must gain insight on the range of activities that water is utilised for, and the importance of such water-dependent activities in sustaining rural households in Borakalalo village. This research looked at 'current water usage patterns' in Borakalalo and identified activities that water is currently used for and, whether or not identified activities play an important role in sustaining rural livelihoods. The phrase 'past water usage patterns' in this research is used to refer to activities that households chose to engage with prior to the water crisis that is presently being experienced in the study site (prior to any time before 2010 when periodic water cuts began to trouble Borakalalo village). A comparison between current and past water usage patterns was useful in revealing whether or not residents of Borakalalo have altered their water usage in response to the plight of water scarcity. The focus need not be on current and past water usage alone, as there may also be some activities that residents of Borakalalo wish to engage with if water was more readily available to them. Unfortunately, because of difficulties in accessing water, it could be that residents of Borakalalo village are somewhat limited when deciding on various water-

[11]Keebine, K., 24 February 2013: Personal communication.
[12]South Africa, 2013: *Ramotshere Moila Local Municipality Integrated Development Plan of 2013-2014,* Report no. 01-01-01, Government Printer, Mafikeng.
[13] ibid

dependent activities they wish to engage with. Thus, this research also looked at potential uses of water, that is, water-related activities that residents of Borakalalo wish to use water for if it were more readily available to them. Furthermore, it is also important to consider how identified potential water-related activities would contribute to household sustainability (Dlamini, 2007; Pérez de Mendiguren & Mabelane, 2001; Ramotshere Moila Local Municipality IDP document, 2013; Ngaka Modiri Molema District Municipality IDP document, 2012; Soussan *et al*., 2003).

There is very little understanding of how water scarcity or abundance affects water usage trends in Borakalalo village. Nonetheless, this problem is not unique to Borakalalo village. There is a general lack of monitoring of rural water usage in South Africa, with very little understanding of the role that water plays in the livelihoods of rural people (Van Koppen, 2003). Literature seems to suggest that rural people do not only use water for domestic purposes, and that water is also an important resource for various productive livelihood activities (Carter, 1999; Soussan *et al*., 2003).

If the argument put forward by scholars who suggest that water is a crucial resource for productive activities that sustain rural livelihoods is true, water scarcity will have detrimental effects on livelihoods of rural people in Borakalalo (Pérez de Mendiguren & Mabelane, 2001; Soussan *et al*., 2003). Furthermore, the effects of water scarcity on households in Borakalalo village cannot be measured without knowledge about the water usage patterns of households in the village. The current situation in Borakalalo is of severe water stress, but nonetheless, questions of how present circumstances affect the livelihoods of local people can only be answered through understanding water usage patterns of villagers in Borakalalo (*Ramotshere Moila Local Municipality IDP document, 2013*). There is a pressing need for research that sheds light on the connection between water availability and livelihood options available to households in Borakalalo. In order to explicitly express the extent to which water affects the livelihood options available to villagers, this research investigated the different forms of water usage in Borakalalo village. This was achieved through looking at the range of activities that households in Borakalalo use water for. The focus was not only on current and past water usage, but also on potential water usage. In an attempt to comprehensively evaluate the consequences of water scarcity on rural livelihoods, this research explored the role that water plays in the livelihoods of households

in Borakalalo village, through identifying water-related livelihood activities and revealing the contribution made by identified water-related activities in sustaining livelihoods of households in Borakalalo village. In view of the observations above, the following questions guided the research process:

1. What are the different activities (domestic or productive activities) that households within Borakalalo village currently use water for?
2. What are the different activities (domestic or productive activities) that households within Borakalalo village previously used water for prior to the water crisis currently experienced in the village?
3. What are the different activities (domestic or productive activities) that households within Borakalalo village aspire to use water for if water was easily accessible to them?
4. What are the existing constraints in accessing water?
5. How are livelihoods of households in Borakalalo village affected by limitations in accessing water?

In addition, the following research objectives guided the research process:

1. To conduct a household survey with 150 households in Borakalalo village.
2. The survey questionnaire uses the sustainable rural livelihoods framework of analysis as a guideline in identifying the different resources that rural households make use of in order to secure a livelihood:
    - The first section of the survey questionnaire looks into socioeconomic resources, specifically with the intention of looking into how access to socio-economic resources influences household interactions with natural resources, particularly water in this instance.
    - The second section of the survey questionnaire focuses on household interactions with water through identifying water-related activities that surveyed households engage with, and thus, determining how those activities contribute towards generating a livelihood income.
    - The survey looks at ‘current water usage patterns’, which can be defined as water-related activities that surveyed households engaged with at the time this

investigation was conducted (that is the period during the water crisis). 'Past water usage patterns' are also explored in order to identify water-related activities that households previously engaged with prior to the plight of water scarcity in Borakalalo village. If there are any changes in the water usage patterns of households from the time prior to the water crises and the time during the water crises, those changes were identified and then assessed in order to establish how noticeable changes in the water usage patterns affect household livelihood sustainability in Borakalalo village. Furthermore, exploring 'potential water usage patterns' was useful in revealing any water-related activities that surveyed households wish to engage with if water was more readily available. It was useful to establish how identified 'potential water-related activities could potentially generate a livelihood for households in Borakalalo village, and thus in a way, uncovering the extent to which water scarcity in Boakalalo village limits household capacity to generate a livelihood.

3. The second section of the survey questionnaire also aimed to unveil different constraints to accessing water in Borakalalo village.
    - Respondents were asked to list any factors that limit their represented households from accessing water.

Chapter two: Methodology

2. Introduction

The main aim of this chapter is to provide a detailed discussion of the various methodological approaches employed in this investigation. The advantages and disadvantages of the different methodological techniques utilised will be highlighted in this chapter. First to be discussed is the epistemological position of the researcher, followed by a review of the research design. The last section of this chapter consists of a methodological reflection and conclusion.

2.1. Epistemological position of the researcher

This section will begin by exploring the epistemological position of the researcher. Floerdew & Martin (1997) argue that a researcher should always make his philosophical position known, reason being, that personal ideologies influence the direction of the research to a significant extent. The worldview held by a researcher influences the final research outcome. A researcher is never neutral and there are always biased positions taken during the research process based on the researcher's personal philosophy. Henceforth, when considering the influential role that a researcher's personal philosophy plays in the production of knowledge in social research, it becomes imperative for every researcher to make his personal philosophy known, and to explore the possible weight that personal views could have on the final research outcomes. This section will explain the researcher's epistemological position through having a brief look at the history of the South African economy, specifically looking at the relationship between the South African urban and rural economy during Apartheid, and the role of women in the Apartheid and Post-Apartheid economy. The feminist position taken by the researcher will be briefly delved into.

A look at the structure of the rural economy in Post-Apartheid South Africa, mainly an exploration of the rise of women in various sectors of the rural economy is essential in highlighting the responsibility that women take on in generating livelihoods in rural South Africa. This section will serve to advocate for the feminisation of rural economies, and argue that rural livelihoods would benefit if women gained more access to rural economic activities that were previously denied to them under traditional African societies and, the

former South African legal framework that has also, to a certain degree, undergone transformation under Post-Apartheid South Africa (African National Congress, 1994). In rural South Africa women play an important role in generating a livelihood income, therefore, it is vital that rural women be equipped with necessary resources and skills in order to increase their capacity to generate a livelihood (Davidson, 1993; Sigenu, 2006).

The Apartheid economy was heavily reliant on a rural labour force. The drivers of the Apartheid economy were migrant workers who came into cities from former home lands mainly for employment purposes. This labour force was primarily made up of African male workers who provided cheap labour to the Apartheid Economy. During this time, the 'Influx Control Policy' restricted the movement of women into urban areas. Consequently, rural women were left to fend for their families, mainly as farm labourers. Although the 'Influx Control Policy' was lifted in 1986, an increase of African women in urban areas was already noticeable in the early 1930's. However, during the 1930's most African women lived in urban areas illegally, and thus able to only secure work in the informal sector through illegal activities such as selling home brewed beer or sex work (Buroway, 1975; Wolpe, 1972).

The argument presented in this chapter is that rural women have always played a significant role in urban economies through interactions with reproductive labour[14]for the Apartheid economy. In the homelands, households were socially maintained by women who remained in rural areas and reproduced the labour force that fuelled the urban Apartheid economy. The financial maintenance of rural households was mostly through remittance, and it was often the role of men to provide financially for their families remaining on the homelands. Fast forward into a democratic South Africa and, it is evident that gender roles constructed during Apartheid have not been completely erased. It is still considered to be the role of women to remain in rural areas and socially maintain rural households, while men on the

[14] Reproductive labour is performed within the domestic realm and, the main purpose of this labour is to produce and maintain a labour force. It is childrearing, childbirth, cleaning or cooking, all of which are important tasks needed in order to maintain a labour force. Workers must eat and, it is the reproductive labour of women that ensures that such needs of the labour force are met. It is women who give birth to men and women who enter the labour force. In essence, reproductive labour is the domestic production and maintenance of the labour force (Federici, 2009)

other hand are still held responsible for the financial maintenance of their rural families (Anderson, 2001; Dickenson, 2002; Duffy, 2007).

This is not to say that a woman's role in rural areas is limited to social responsibilities within the domestic realm. Quite contrary, the role of rural women in gaining a livelihood has expanded. Women have now gained access to roles that were previously denied to them. More and more rural women are beginning to seek for means of generating a livelihood outside their traditional roles. Women now engage with activities such as brick laying, cattle herding and shoe making, these are all examples of activities that were previously male dominated. Household labour transformation can be linked to the breakdown of traditional African patriarchies in various social intuitions in Post-Apartheid South Africa. The structure of families, specifically the structure of conventional African families, has undergone some changes after the eradication of Apartheid. For example, the abolishment of Apartheid came with the introduction of new rights and opportunities for women that were previously denied to them. Hence traditional patriarchal gender divisions that existed in African families are often challenged, even though not completely removed (O'Laughlin, 1997; Urmilla, 2008).

In rural areas, where women now engage with activities that were previously dominated by men, there is a pressing need for both social and economic transformation. It is crucial that women gain access to resources that were, and still are to a certain extent, controlled by rural men. For example, women in rural areas need to be allowed more access to agricultural skills and training, as well as agricultural inputs such as seeds, fertilisers, water and land. Although it is mainly women who engage with subsistence agriculture, agricultural resources are controlled mostly by men. Considering the important role that subsistence agriculture plays in ensuring food security in rural areas, it is vital that subsistence production be stimulated through empowering women with the necessary agricultural skills and resources. Making women more productive agricultural farmers has the potential to decrease the level of food insecurity in rural areas (Randriamaro, 2002; Sigenu, 2006). Women do not only need to be given access to resources, but also skills that will enable then to generate livelihoods for themselves, not only through agriculture but also through various economic activities. The feminisation of rural livelihoods needs to become a priority if rural households are to become more sustainable in the 21st century.

The feminisation of the economy in general, especially the rural economy, is essential for dismantling oppressive gender based power relations. It is important that women have the full capacity to generate a livelihood for themselves. This is even more necessary in the fight against HIV/Aids, women and child abuse. Women who do not have the means to generate a livelihood may be forced to subject themselves or their children to sexual, physical and emotional abuse, or other forms of oppression out of fear of poverty (Hunter, 2007).

In rural areas of South Africa, gender influences access to a variety of resources. It is thus crucial to investigate the role that gender plays in determining access to water in Borakalalo village. Due to the fact that gender plays an influential role in determining access to resources, it can be argued that gender has a part to play in shaping household sustainability in rural areas. Additionally, Sass (2002) makes the claim that African rural women are the most vulnerable to water scarcity. In African rural areas women tend to engage more with water-related activities/duties than men. Consequently, gender in rural areas influences access to water. While gender roles on the other hand, play an influential role in determining who engages with water-related activities the most and who is the worst affected by water scarcity (Randriamaro, 2002; Sigenu, 2006).

2.2. Research design

The chosen research methods must be able to answer the research questions guiding the investigation. Overall, this section will outline and also justify the choice in the chosen research methodology. A researcher must choose research methods that are most suitable for the research at hand, and also, the research methods must be compatible with the research site (Bryman, 2004). In this research semi-structured interviews were employed.

The focus of this research was to probe the relationship between rural livelihoods and water scarcity or availability in Borakalalo village. This investigation aimed to look at different forms of water usage patterns in Borakalalo village and, to enquire how different water-related activities are affected by the ability or inability to gain access to water (inability to access water is referred to as water scarcity). Through examining how water scarcity or availability affects activities that rural people choose to engage with, this study could gain an understanding of how water affects the livelihood options available to villagers in Borakalalo. The focus was not only on current and past water usage patterns, but also, the

study focused on potential water usage, if water was more readily available in Borakalalo village (Earle & Phemo, 2005; Moriarty & Butterworth, 2003).

This study did not only look at water and livelihoods in isolation. Instead, the investigation aimed to measure the sustainability of rural livelihoods by giving various aspects of livelihood sustainability much needed consideration. Water is only one aspect of a livelihood, it is an important aspect for measuring rural livelihood sustainability, but it is not the only aspect that should be considered. For example, water goes hand in hand with other resources such as fertile soil or agricultural seeds. Also, a household that has the ability to generate an income through other means that do not require water could be less dependent on water than a household that makes use of water for productive or small-scale business enterprises (Pollard *et al.*, 2002). Therefore, the socioeconomic, political and even historic context of every household should be understood in order to assess the degree of water dependence in a household. It was thus crucial that a livelihood framework that looks at livelihood sustainability in a holistic manner be employed. Such a framework considers social, economic, political and environmental factors that influence livelihood sustainability. This study made use of the sustainable rural livelihood framework of analysis as a guideline in compiling the semi-structured interview guide for this investigation. One section of the interview guide is a questionnaire that aims to uncover the socioeconomic status of surveyed households, while the other section of the interview guide is made up of open ended questions aimed to reveal the relationship that households in Borakalalo village have with water (Bebbington, 1999; Gilimani, 2005; Scoones, 1998).

The rural livelihoods framework was used to scrutinise rural household sustainability through the analysis of various aspects that makeup a livelihood. This was done through, firstly, analysing the socioeconomic sustainability of surveyed households. The first section of the interview guide that looks into the socioeconomic aspects of surveyed households focused on the history, culture, demographics and economics of sampled households. Although the first section of the interview was not focused on the interactions that households have with water, in some cases, the subject of water did come up, especially in cases where water is closely related to the economic activities of the household. The second half of the interview questions were centred on assessing the household's present interactions with water on a daily basis and, establishing how those interactions contribute

to livelihood sustainability. Additionally, past and potential interactions with water were identified and explored. The framework was used to analyse the resource base of households in Borakalalo village. Be it natural resources, economic/financial resources, human resources or social resources, all aspects were considered, because ultimately, all resources influence livelihood sustainability. Also, formal and informal institutional processes and organisational structures that influence access to resources were given careful consideration and, this was done in order to gain an understanding of factors that influence access to resources in Borakalalo village. In rural areas, traditional institutions such as: traditional leadership, kgotlas or other traditional hierarchies may determine access to resources. There are other examples of formal institutions such as local authorities and social welfare departments that also determine access to various resources (Chambers & Conway, 1991; Mucavele, 2006; Scoones, 1998). Ultimately, to understand the social and cultural aspects of a household is to understand the social processes involved in deciding on household livelihood strategies.

2.3. Choice of study site

Borakalalo village is the chosen study site for this research. Borakalalo is located in the North West Province of South Africa (Lehurutshe district) approximately 40 km North West of Zeerust. It is estimated that 35% of the total area in Lehurutshe district is rural, with most of the land under traditional authority. Lehurutshe falls under the Ramotshere Moila Local Municipality, and the Ngaka Modiri Molema District Municipality. This region is classified as semi-arid and the dominant vegetation type in the region is turf thorns and mixed bushes (*Ramotshere Moila Local Municipality IDP document*, 2013). According to Statistics South Africa the total population in Borakalalo village was 9659 in 2011, with a total of 2645 households in the village (*Statistics South Africa*, 2011).

Lehurutshe, where Borakalalo village is located, is dominated by Tswana people who rely mostly on livestock breeding, petty trade and migrant work (*Centre for climate change research at the University of Sheffield*, 2003). A study conducted on Mantsie village, a small village about 5km away from Borakalalo, revealed that the dominant soil types in the region are Apedal soil and Clayey Plinti-Catera soil. Both Apedal soil and Clayey Plinti-Catera soil are red-yellow in colour, Plinti-Catera soil is ideal for crop production while Apedal soil is

highly subject to soil erosion. These findings are from a study that was conducted in 2003 by the Centre for Climate Change Research at the University of Sheffield. This particular study focused mainly on climate change and adaption in the village of Mantsie in Lehurutshe district.

According to the Ramotshere Moila Local Municipality IDP document (2013) most households in Borakalalo village depend mainly on piped water. A total of 1356 households in Borakalalo receive piped water from in-dwelling taps (Inside the yard) while 391 of households receive water from taps inside dwelling or institution (Inside the house). Moreover, some 586 households have access to piped water from community stands located less than 200m from dwelling, while 124 households access piped water from community stands that are located between 200m to 500m from dwelling. A total of 84 households in Borakalalo access piped water from community stands located between 500m to 1km away from dwelling. In addition, 14 households in Borakalalo access piped water from community stands located more than 1km from dwelling, and 82 households do not have access to piped water. Some 7 households receive water from unspecified sources (*Statistics South Africa*, 2011).

Due to the current water crises in Borakalalo village, poor delivery of piped water has meant that some households that used to rely on piped water either directly from in-dwelling taps or from community stands now rely on Jojo water tanks. Poor piped water delivery has affected households that depended solely on piped water the most. Some high-lying households in Borakalalo village that previously received piped water, either from community or in-dwelling taps, have not received piped water for almost a year. On the other hand, households in low-lying areas of Borakalalo village experience piped water cuts that last for days or weeks on hand.[15]One of the major reasons behind water shortages in Borakalalo village is that water demand now outweighs the dam capacity to provide water for the village. According to a report by the local municipality, the registered abstraction of water from the Sehujwane dam, which provides water to Borakalalo and some of the surrounding villages, is 0.839 million m3/a, and the calculated water requirements for these villages is 0.850 million m3/a. An increase in number of households in the region plays a

[15]Keebine, K., 24 February 2013: Personal communication.

pivotal role in the delivery of basic services, such as water and sanitation mainly because basic services are delivered per household (*Ngaka Modiri Molema District Municipality & Ramotshere Moila Local Municipality,* 2011).

2.4. Sampling

Marshall (1996) argues against random sampling in qualitative research. Random sampling is a quantitative sampling method that aims to represent general trends in society rather than understanding social values that inform human behaviour. Even so, Neuman (2000) argues that the sample should capture the variation within a population. Considering arguments made by both scholars, stratified sampling was chosen as the most suitable sampling technique for this research.

Borakalalo village is divided into eight sections. The largest section, labelled section A on figure 2 has a total of 214 households that are visible on a household map of that particular section provided by Statistics South Africa (see all maps referenced here under Appendix 2). This section is followed by the section labelled F with 157 households. The section labelled D consists of 161 households, while the section labelled E has 152 households. The fifth largest section is the section labelled B with 151 households, and the section labelled G has 139 households. Section C is the second smallest section with 132 households and the smallest section is section H, which consists of a total of 119 households (Statistics South Africa, 2013).

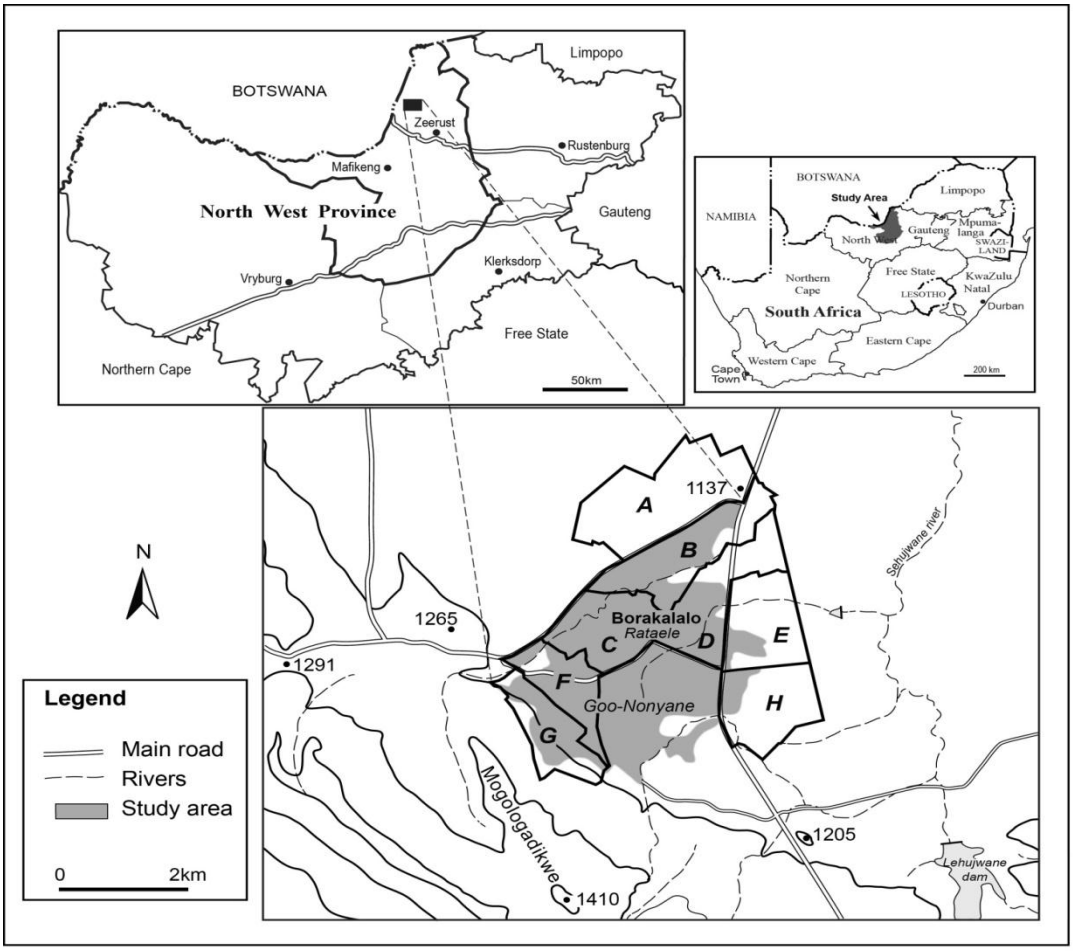

Figure 2: Map of Borakalalo village showing the different sections of the village.

The total number of households sampled in Borakalalo village is 150 households. The most suitable argument for justifying the sample size is the argument made by Marshall (1996) who states that an appropriate sample size in a qualitative social study is one that is large enough to allow the researcher to effectively answer the question at hand. Henceforth, a sample size in a qualitative study can be determined arbitrarily, dependent on whether or not the research questions at hand have been effectively answered and, whether the point of data saturation has been reached. Marshall *et al*., (2013) describes the concept of data saturation as the point of redundancy. To reach the point of redundancy participants are continuously added into the research to the point whereby the data collected from the participants is identical to data that already exists in the data set, at this point participants are not adding anything new to the data set. For this reason, qualitative researchers describe this point of redundancy as data saturation. Patton (2002: 242-243) further argues that: "There are no rules for sample size in qualitative inquiry. Sample size depends on what

you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources".

Maps of every section of Borakalalo village were provided by Statistics South Africa and, revealed a total number of 1225 households in the village (Statistics South Africa, 2013). On the other hand, 2011 census data revealed a total of 2645 households in Borakalalo village (Statistics South Africa, 2011). Maps provided by Statistics South Africa (Stats SA) are based on a physical household count from aerial photography, and thus Stats SA maps were more useful in stratifying and selecting a sample for this investigation (See Appendix 2).

In every section of the village, except for only one out of the eight sections, the total number of households per section was within the range of 119 to 157 households. Only one out of the eight sections had 214 households. For this reason, in the seven sections of the village where the number of households ranged within 119 to 157, a total of 18 households were sampled per section. This total was decided on because it is above 10% of the total number of households in all the seven sections. For the section consisting of 214 households a total of 24 households were sampled, which is more than 10% of the total number of households in that particular section. As a result, in every section of the village, a minimum average of 10% of the total number of households per section was sampled. Setting a percentage standard of 10% in every section of the village was useful in ensuring a fair representation of households in all sections of the village. A percentage standard prevented the error of having majority of participating households concentrated in one section of the village and having very few households in other sections, from taking place and thus creating disparities in the sampling technique. Every sample stratum has to be fairly represented Neuman (2000). Additionally, it was crucial that every section of the village be fairly represented due to the fact that water scarcity is temporally and spatially variable (Rosbjerg *et al.,* 1997).

Borakalalo village is divided into eight sections and, these eight sections than served as sample strata. Furthermore, in every stratum participating households were chosen using the following technique:

- The household maps provided by Statistics South Africa were used as a guide (See maps under Appendix 2).

- Every household in every stratum/section of the village was numbered on the map.
- Household 1 (based on the household numbers on the map provided by Statistics South Africa) was the starting point in every sample stratum and, between every participating household, four households were excluded from the study
- For example, household 1 would be the starting point, from then onwards four households are skipped, skipping household 2 to 5. This means that the 6thhousehold would then be the next participating household, which is actually the 5th household when including the 1st household in the research sample and counting from the 2nd household to the 6th. The 6th household is then the next to be included in the research sample (See figure 2.1).

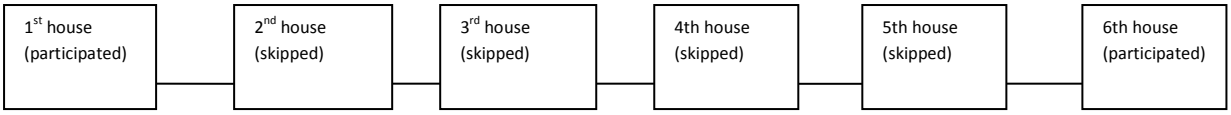

Figure 2.1: Diagram demonstrating the interval scale used in this research.

Skipping four houses between every participating household automatically excluded 68 households in each section (this only applies in the sections where only eighteen households were sampled). Nonetheless, this was not problematic because every section had enough households for this interval to be used. In the section with the least amount of households (section H with 119 households) after automatically excluding 68 households, as a result of skipping four households between every participating household, 51 households were remaining, and only 18 households out of the 51 households were sampled. In the section where 24 households were sampled (Section A) 92 households were automatically excluded from the sample. This meant that 122 households were remaining, and out of those remaining households 24 households were sampled. Therefore, the sampling interval used in this study was appropriate and suited all sections of the village, ensuring that 10% of households in every section of the village are included in the study (Hahn & Meeker, 1991).

This interval came with its disadvantages, in some cases, people were absent at the selected households. In order to avoid derailing from the set sampling interval, at times the researcher had to return to one household more than once until there were people present to interview at that particular household. People were generally willing to participate, but the only problem was whether or not people were present at their houses at the time of the

study. People's willingness to participate was as a result of a radio broadcast made on the local radio station about the research. Making people aware that research was being conducted in their village, as well as letting them know as much detail as possible about the research on the local radio station helped in establishing rapport with some residents of the village. In some cases neighbours were really helpful. If people were absent at selected households it was helpful to speak to the neighbours, leaving them with contact details and asking them to make contact whenever people at the selected household were present and available to participate in the survey.

2.5. Research tools

In this research semi-structured interviews were used in order to allow the respondents to express their experiences without limiting them. Using a tight interview structure leaves little room for respondents to voice their opinions. Overall, a total of 150 households participated in this project, and there was no limit set on the number of respondents that could participate in every household. As a result, in most cases interviews took the form of a discussion with one or more household members. Members of one household may perform different livelihood activities (Scoones, 1998). For this reason, including as many members of a household as possible ensured that different livelihood activities, which may be performed by different members in a household, are considered. Also, this research did not set a limit to the number of male or female respondents to be included in the investigation.

The interview guide was divided into two sections. The first section took the form of a questionnaire and was meant to gain information about the socioeconomic status of the household. The second section of the interview guide consisted of open ended questions that were meant to guide the participants into a discussion about household interactions with water.

People under the age of 18 (children) were not included in this research project. It goes against research ethics to interview children unless the researcher has applied for ethics clearance and, permission has been granted to include children in the research sample. Although ethics clearance was granted for conducting this research, ethics clearance was granted only for interviewing adults and not children due to the fact that children are considered to be a highly vulnerable population (Morrow & Richards, 1996). Nonetheless,

children play an important role in accessing certain livelihood opportunities within a household (Bebbington, 1999). For that reason, this study attempted to include the role of children and their experiences through an indirect source. Interview questions were designed in a manner that will address and find out more about the role of children through the respondents.

2.6. Data analysis

Fieldwork data were collected from January to June 2014. The semi-structured interview guides used in this research consisted of two sections. Therefore, both sections were analysed differently. The first section of the semi-structured interview guide was in questionnaire format, consisting of questions requiring standardised answers. Data from the first section of the semi-structured interview guides were analysed using Microsoft Excel 2010. However, there were also some questions in the second section of the interview guide that also required standardised answers. As a result, answers to such questions were also analysed using Microsoft Excel 2010. A minimum of one and a maximum of three interviews were conducted daily.

Some of the interviews were recorded using an audio recorder, while in some interviews participants were not comfortable with the use of an audio recorder. In a case were participants did not feel comfortable with the use of an audio recorder the researcher refrained from making use of the tool. Recorded interviews were transcribed daily and, some information was then transferred into Microsoft Excel were necessary. However, not all information collected from the interviews was suitable for Microsoft Excel, mainly because the second section of the interview was made up of open ended questions to guide a discussion between the participants and the researcher. Therefore, the second section of the interview was analysed using thematic content analysis. Once all data were collected and transcribed, all transcripts were read and reoccurring themes were manually identified and colour coded (Braun & Clarke, 2006).

2.7. Reflection and conclusion

The strict sampling procedure used was effective in ensuring that sampled households were not concentrated in one area of the village, but rather, dispersed evenly in all parts of the village, giving a fair representation of household experiences in Borakalalo. However, in order to avoid derailing from the chosen sampling technique, houses chosen to participate in the study had to be visited more than once in some occasions, mainly if the members of the household were absent upon the first visit. Having to revisit houses was time consuming, and perhaps randomly selecting houses within every stratum would have been the better and most time effective sampling method.

The added advantage of being an insider in the village made accessing participants easy. Being able to communicate to participants in a language that they understand also assisted during the research process. Most participants were trusting of the researcher, and rapport was established without much difficulty. Furthermore the local radio station informed the participants about the research, and so residents of Borakalalo village were more than willing to participate. Two cattle herders who are very familiar with the village were also helpful in guiding the researcher through the village.

Chapter three: Literature review

3. Definition of key concepts: conceptual dilemma

There is a conceptual dilemma surrounding the term water scarcity. The problem lies in the fact that the term water scarcity refers to a general water shortage but makes no reference to the various conditions that lead to a water shortage. Water can either be physically scarce or economically scarce. However, the term water scarcity does not always fully capture the true nature of a water shortage, and often, the term water scarcity is interpreted as a physical shortage of water (Falkenmark *et al.*, 1989; Postel, 2000; Rijsberman, 2006).

Physical water scarcity refers to a shortage of water caused by various environmental conditions. Some examples of environmental conditions that may lead to water scarcity are: water resource degradation or depletion and unfavourable climatic conditions such as droughts. For example, arid regions are more prone to water scarcity due to the frequent occurrence of droughts, and also, the likelihood of water scarcity is high in regions where water resources are degraded due to pollution. In both examples cited above, water scarcity is caused by unfavourable environmental conditions, and thus, the term physical water scarcity is appropriately used in this instance. Physical water scarcity can be human induced, caused by anthropogenic activities such as water polluted through acid mine drainage, or it may also be a natural process such as in the case of a seasonal drought. Economic water scarcity, on the other hand, refers to a lack of access to water due to economic obstacles that prevent the efficient supply of water. In some developing countries water may be physically available but economically scarce. Countries that are experiencing economic water scarcity suffer from poor water service delivery caused by old, damaged or inadequate water infrastructure (Falkenmark *et al*., 1989; Sullivan *et al*., 2003; Tyler and Miller, 1996; Winpenny, 1999).

Also included in the term water scarcity, but often not explored, is the concept of water security. Rijsberman (2006) defines water security as having access to safe, sufficient and affordable water to satisfy basic human needs. Although a region may not be experiencing either physical or economical water scarcity, it may be that there are individuals within that region who are water insecure due to their inability to pay for water or any other

constraints in accessing water. Water scarcity is when a 'large number of people' in the same region experience water insecurity for a significant period of time. Winpenny (1999) adds that there are three degrees of water scarcity, absolute water scarcity is the most severe form of water scarcity, lasting for life-threatening periods of time, whereas seasonal water scarcity is temporary. However, because there is no clear indication of what a 'large number of people' is in terms of numbers, or what time frame is used to measure whether or not water insecurity has escalated to water scarcity, the difference between the terms water scarcity, water insecurity and water shortage are not clear cut. A water shortage is similar to water scarcity in the sense that it affects what is referred to as 'a large number of people', however the time frame of a water shortage is shorter than that of a water scarcity. A water shortage may escalate to a water scarcity if it lasts for a 'significant period of time'. Distinguishing between a water shortage and water scarcity is problematic because there is no set standard for what a 'significant period of time' is. Therefore, both these terms are open for interpretation, and as a result, tend to get used interchangeably (Rijsberman, 2006; Schmandt, 2001).

Water is the most crucial resource for sustaining human life. Access to water secures access to a variety of other resources, food being the most important of all. Food resources are currently under threat due to water scarcity. Although advanced technological developments in agriculture have accelerated growth of the agricultural sector, the green revolution, characterised by significant developments in the agricultural economy, has had some negative side effects on the environment. Over the years reference has been made to increased agricultural production as one of the causes of environmental degradation and climate change. Therefore, large scale agricultural production that has been witnessed over the years is a contributing factor to water scarcity, which is one of the symptoms of climate change. Even though commercial agriculture has blossomed over the years, contrary to what one would expect, this has not resulted in a significant decrease in hunger and malnutrition. Most cases of hunger and malnutrition are found in rural areas of the developing world. This shows that even though there has been growth in agricultural production, this growth is not evenly distributed across the globe. The poorest of the poor in rural areas of developing countries have not benefited as much as they should from the green revolution. Instead, environmental problems such as water scarcity pose a threat to

food security in rural areas of developing countries (Ellis, 2000; Reardon & Vosti, 1995). The Food and Agriculture Organization of the United Nations (2012: 2) states that "agriculture is both a cause and victim of water scarcity." This implies that it is mainly because of water scarcity that agricultural production in poor countries is limited, and thus food security in developing countries is a growing concern, but at the same time, environmental problems such as water scarcity (associated with climate change) have been linked to technological advancements made in the agricultural sector and the acceleration of agricultural production over the years.

3.1. Water scarcity on a global scale

On a global scale, only 2.5% of available water is freshwater suitable for human consumption (Gleick, 1993; Oki & Kanae, 2006). This statistic seems to suggest that even though there is an abundance of water resources, it is also important to note that not all the available water is suitable for human consumption. Although 70% of the earth is covered by water, most of it is saline ocean water and, only 1% of freshwater is stored in easily accessible forms. Instead, most of the freshwater covering the earth's surface is stored in glaciers or ground water, making this water difficult to access for human consumption.

Oki & Kanae (2006) suggests that international research on water should move away from the available stocks of water, when measuring water scarcity, and concentrate more on the flow of water. Looking at annual precipitation data, for example, is a method that concentrates on stock rather than flow. Precipitation data reveals not the amount of water lost through evaporation, or whether water is accessible for human consumption (Feitelson & Chenoweth, 2002; Gleick & Palaniappan, 2006; Molle & Mollinga, 2003). In addition, precipitation data does not consider the concept of an ecological water reserve that needs to be maintained in order to preserve ecological integrity. A loose definition of an ecological water reserve is as follows: the total quantity and quality of water needed in order to maintain the ecological balance of a water ecosystem, and therefore, under ideal circumstances an ecological water reserve should remain untouched. More specifically, van Wyk *et al*., (2006: 404) states that "*The Ecological reserve is an allocation of water specified as a volume and quality underpinned by flow and duration requirements to sustain the specified river ecosystem".* Precipitation data is based on the assumption that all water that

reaches the earth's surface is suitable or available for human consumption, whereas there are various economic, social and environmental factors that determine access to freshwater (Rijsberman, 2006).

Problems associated with water scarcity are visible in developing countries of the world. There is evidence of problems in ensuring food security due to water scarcity, mainly in rural areas where the population depends on subsistence agricultural or livestock farming. Additionally, water borne diseases such as cholera also continue to challenge developing nations (Gleick, 2002). Not all available water is suitable for human consumption, and thus, one cannot talk about water scarcity or availability without considering the quality of available water. In other words, recorded water stocks do not account for quality of available water and, when measuring water scarcity both quantity and quality are important aspects to consider (Brown, 2011).

Economic factors also determine whether infrastructural investments can be put into ensuring access to water that is safe for human consumption. Therefore, although water can be available in the physical sense, what may be lacking is the kind of water infrastructure and water treatment facilities that would make it possible for available water to be utilised for human consumption. A state whereby water is physically available but economically inaccessible is called economic water scarcity. It is important to note that precipitation data and different indicators that concentrate on available water stock do not consider whether or not there exist the financial capacity to make the necessary economic investments for securing an adequate water supply (Oki & Kanae, 2006; Rijsberman, 2006; Seckler *et al.,* 1999).

Current freshwater withdrawals are low on a global scale and, on a global scale water scarcity does not seem to be a major problem. However, this is because looking at water scarcity on a global scale ignores the uneven distribution of freshwater. Although there is generally enough water on earth, there are some regions in the world that are experiencing severe water stress. Therefore, looking at the availability of freshwater on a global scale may be misleading, failing to represent water scarcity on a continental, regional or local scale. Not only is water spatially variable, it is also temporally or seasonally variable. A region may have abundant water in one month and experience water scarcity the next

month. Such variability is often not well represented in a global study on water scarcity (Oki & Kanae, 2006; Vörösmarty *et al*., 2000).

Even though the availability of water may not seem like a major concern on a global scale, on a local scale gaining access to water is challenging for many, especially for the rural population in the developing world. Developing countries are struggling to secure an adequate water supply due to poor water infrastructure. Environmental policies need to strike a balance between the developmental needs of emerging economies and the need to preserve the environment, mainly water resources. The challenge in developed countries is to reduce the demand for water to sustainable levels, while the challenge in developing countries is ensuring adequate access to water for economic and social development, nationally and locally, while implementing legislative measures that will ensure that water usage for developmental purposes takes place in a sustainable manner. In rich societies of the developed world, privilege is demonstrated through unsustainable levels of water consumption. While in the developing world, on the other hand, economic challenges constrain efficient and reliable access to water (Oki & Kanae, 2006; Rijsberman, 2006; Seckler *et al.,* 1999). It is crucial that measures that ensure that water withdrawals do not increase to unsustainable levels, as well as measures that prevent deterioration of water quality be implemented. This will require stricter water policies on a national level and better management of water on a local level (Vörösmarty *et al*., 2000).

3.2. Water related conflicts

Water is a highly contested resource that continues to give rise to conflict between countries that rely on shared water resources. Most water sources are shared by two or more countries, and often, sharing a water resource is not a smooth process. Water conflicts are taking centre stage in international politics due to the uneven distribution of water, as well as the need for many nations to secure an adequate water supply for economic development (Ansink, 2009; Gleick, 1993; Klare, 2000; Klare, 2001). As the likelihood of water related disputes increase, it also becomes increasingly important for international policy makers to ensure that international laws minimise the possibility of such conflicts from occurring. However, there are concerns that international law may not be able to handle the rise of water related disputes (Gleick, 1993).

The Jordan River basin in the Middle East continues to cause conflict between countries that share this resource. The Jordan basin is shared by Syria, Israel, Jordan and Lebanon. To make matters worse, there are few alternative major water sources in the region. In 1967 attempts from members of the Arab league to divert the headwaters of the Jordan River from Israel was a contributing factor to the war that took place at that time, known as the 'Six day war'. Israel occupied most of the head waters of Jordan River, while Jordan was denied a significant fraction of its river by Israel (Bjorn, 2001; Gleick, 1993; Lowi, 1999; Starr, 1991).

Major water developments that may benefit one nation and disadvantage another often result in water related conflicts. In most cases, downstream nations are the most vulnerable to such developments. Upstream water developments are notorious for displacing downstream populations and resulting in changes in the ecosystem. The construction of irrigation projects in South-Western United States of America (USA) led to the degradation of the Colorado River that also supplies Mexico. The quality of water delivered to Mexico was affected by constructions undertaken in USA territory, and subsequently, the Mexican economy was affected by the deteriorated water quality. Major water related political disputes then erupted between America and Mexico. However, the disputes were resolved through diplomatic negotiations. In contrast to the situation between the USA and Mexico, there are unresolved tensions between Turkey, Syria and Iraq over dam developments undertaken by Turkey as part of the Grand Anatolia project that includes irrigation and hydropower schemes (Haftendorn, 2000; Starr, 1991).

In Africa, the Nile River is shared by a number of countries, namely: Egypt, Sudan, Ethiopia, Kenya, Rwanda, Burundi, Uganda, Tanzania and Zaire. Any water developments that take place in any of the upstream nations will have detrimental effects on the arid nation of Egypt. Having the strongest military backing has worked to the advantage of Egypt, which has openly expressed its willingness to use force in order to secure an adequate water supply. The 1959 treaty that was signed only by Egypt and Sudan presented solutions for some of the major issues surrounding the use of the Nile. Unfortunately, the treaty does come with its limitations for Sudan. The nation of Sudan has abundant fertile land and the potential to increase its agricultural production, if it were to increase its irrigation water withdrawals from the Nile. Even though Sudan has sufficient water in theory, the reality is

that Egypt controls most of the water from the Nile. If Sudan is to increase its water withdrawals from the Nile River for irrigation purposes, the 1959 treaty that was signed by Egypt and Sudan will have to be renegotiated. Unfortunately for Sudan, Egypt was not open to renegotiations until recently in 2015. Prior to that, Egypt had also undertaken major water developments that have affected Sudan. The construction of the Aswan Dam by Egypt has led to flooding in downstream nation of Sudan. Conflict over the Nile serves as evidence of how political and military powers also determine access to water (Conca, 2006a; Conca, 2006b; Starr, 1991). Nonetheless, on the 24th of March 2015 a preliminary accord was signed between Egypt, Sudan and Ethiopia. The purpose of this framework agreement is to ensure that any further developments on the Nile does not reduce water supply or disadvantage any of the three nations in any way. The preliminary deal served to put Egypt and Sudan at rest about the construction of the Renaissance Dam in Ethiopia. Hailemariam Desalegn, the Ethiopian Prime Minister, confirmed that the construction of the Renaissance Dam will not in any way harm the three nations that have come into agreement about the use of the Nile River.

International water conflicts are an indication that water scarcity is a growing global concern. Although this paints the bigger picture of the general effects of water scarcity on international politics, there is still a need to understand the direct effects that water scarcity has on the livelihoods of poor rural people in the developing world (Alam, 2002).

3.3. Water scarcity in rural parts of the world

In the year 2000 85% of the world's urban population had adequate access to water, in contrast to only 47% of the rural population that had access to an adequate water supply in the same year (Leonard, 2003). Furthermore, in African countries more than half of the population lives in rural areas, 75% of the African population is rural and thus faced with the growing challenge of water scarcity (Pelser, 2001).

In parts of Kenya and Ethiopia water scarcity has led to competition for water between pastoral communities. Production systems in these parts of the world, like in most rural areas of the developing world, are threatened by deteriorating environmental conditions. Pastoral activities (livestock farming and agriculture) are now threatened by desertification and problems related to poor management of natural resources. Consequently, there is

increased water related conflict between pastoral communities in this region. The conflict between Kenyan and Ethiopian tribes serves as an example of how environmental challenges associated with climate change, water scarcity being the most salient in Africa, are affecting rural communities in the continent (Powers, 2011).

The Usanga Plains in south-western Tanzania became the desired destination for environmental migrants in search of alternative water sources and other natural resources including; alternative grazing and arable land. The Usanga plains became desirable for most rural dwellers due to the plains' perennial and non-perennial wetland habitats. Many of the environmental migrants who took to the Usanga plains are pastoral migrants. There is growing conflict between long-term residents of the Usanga plains and new migrants over access and control of resources in the region, and specifically control over water (Charnley, 1997).

In rural Bangladesh ponds are the main source of drinking water. Villagers are often forced to migrate into urban areas due to changes in rainfall patterns and an increase in water salinity. Urban migration is the only response to deteriorating water quality and increasing water scarcity for many people who are faced with such challenges in villages of Bangladesh. The lack of access to water continues to threaten food security for the rural people of Bangladesh who depend mostly on irrigated agriculture (Kartiki, 2011; Reuveny, 2007).

3.4. The need for resource redress in rural South Africa

The rural population of South Africa composes of 1.5 million households living on commercial farms (mostly white) and 2.3 million households living in the former homelands. A legacy of discrimination and inequality is still evident in rural South Africa, more especially when it comes to resource allocation. In most South African rural areas there is a need to reallocate water to the poor and previously disadvantaged populations (Perret *et al*., 2006).

Kirsten *et al*., (2000) paint the current picture of inequality in resource distribution in rural areas by stating that approximately 83% of agricultural land is owned by white farmers, while about 96% of irrigation water is owned by private and cooperative schemes and irrigation boards. Water use in rural South Africa was dominated by irrigation for commercial farming. During Apartheid there existed irrigation schemes that were

encouraged by the Apartheid government in an effort to increase food security in the former homelands through community gardens and, to prevent an influx of African people in urban areas. However, most of the government water subsidies were for commercial farming and not for smallholder irrigation schemes that benefited the rural poor in the homelands. Perret *et al*., (2006: 4) argues that: *"apartheid involved incentives, laws and institutions that favoured large farms and discriminated against smaller, labour intensive farming systems. Apartheid also gave large white farms privileged access to natural resources, financial and agribusiness facilities, and rural infrastructures"*.

The black rural population lived, and still continues to live, in poor conditions with no running water, very few irrigation schemes and very little access to agricultural land. Water infrastructure in rural South Africa still needs further development. Most of the former homelands are still experiencing economic water scarcity due to poor water infrastructure (Lipton & Ellis, 1996; Molobela & Sinha, 2011).

Since the end of Apartheid, the government has introduced strategies that aim to eradicate rural poverty and inequality, through radical resource redress policies (African National Congress, 1994). The contradiction in government legislation came with the introduction of the Basic Human Need and Reserve (BNHR) that was enacted to the 1998 National Water Act. The aim of the BHNR was to ensure the allocation of basic human water need to all, and to introduce the concept of a reserve, both human reserve and ecological reserve. Contrary to what the BNHR initially intended to do, it relies heavily on the standards set by the free basic water policy of 2000, which makes a provision of 6000 litres of free water per household per month an entitlement. Although 6000 litres of free basic water per month per household may be enough for domestic purposes, the concern is that 6000 litres per month may not be sufficient for rural productive activities that require water (Molobela & Sinha, 2011; Perret, 2002; Pollard *et al.*, 2002). Limiting the free basic water entitlement to 6000 litres a month may pose a threat to the sustainability of rural households that are heavily reliant on water for productive purposes.

3.5. Water scarcity in South Africa

South Africa is a semi-arid country, with only 9% of the annual rainfall ending up in rivers and 5% of rain ending up in ground water aquifers (Midgley *et al*., 1994; DEA, 2011; Schulze

2005). Furthermore, South Africa is known for extended dry and wet conditions that create extreme temporal and spatial variability in water availability (Tyson, 1971; Tyson *et al*. 1997). In terms of access to water, the Department of Water Affairs and Forestry (2009) estimates that one in ten South Africans do not have access to basic water supply and three in ten do not have adequate sanitation.

Rosbjerg *et al.,* (1997) predicted that early in this century South Africa will be classified as a water scarce country along with countries such as Egypt, Israel, Kenya and Malawi. South Africa has an annual rainfall of 495mm, way below the world annual rainfall average of 1033mm (Hedden & Cilliers, 2014). The rainfall distribution is highly uneven with 21% of the country receiving less than 200mm and, 65% of the country receiving less than 500mm of rainfall annually. Making matters worse is the fact that the annual potential evaporation in South Africa is approximately four times higher than the average rainfall per year (Schreiner & Hassan, 2011).

It is estimated that 9.7 million (20%) of the South African population does not have access to an adequate water supply (Kahinda *et al.,* 2007). The South African Department of Water and Forestry (2002) predicts that these conditions will worsen by the year 2025. An increase in water demand from 13280 million cubic meters per annum in the year 2000, to 17248 million cubic meters by the year 2025 is predicted, and thus an expected water deficit of 1788 million cubic meters by 2025. Furthermore, the effects of water scarcity will be the most detrimental in the northern, south-western and central regions (Basson *et al*., 1997). Rising water demand in South Africa is caused by increasing population and on-going industrial developments, more especially electricity generation (DEA, 2011). Therefore, South Africa is faced with the dilemma of having to ensure access to water for all, while improving on water management on a national, regional and local scale at the same time. Water quality in South Africa is also a major concern. Surface water quality is the most threatened by pollution due to mining activities, agricultural production, urbanization and power generation. In South Africa many of the nation's major cities are located upstream while storage facilities (dams and reservoirs) are located downstream. For this reason, most of the country's storage facilities are contaminated with Phosphorous pollution due to poor sewage treatment. Furthermore, with average orthophosphate levels at 0.73 mg/l, cyano bacterial blooms have been occasionally observed in the country's river and reservoir

systems (Ashton *et al.,* 2008; Oberholster & Ashton 2008; Du Preez & Van Baalen, 2006). Groundwater quality is variable in most parts of the country. Groundwater contamination in South Africa is mostly caused by on-site sanitation and mining effluents (Usher & Vermeulen, 2006). High levels of Nitrate in the country's groundwater make 27% of abstracted ground water unsafe for human consumption based on the water quality parameters set by the World Health Organization (WHO). The WHO states that the safe Nitrate level in water is not more than 10mg/l $N\text{-}NO_3$, while on the other hand, Nitrate levels of over 500mg/l can be found in some of South Africa's abstracted ground water (Tredoux & Talma, 2006).

Van Koppen (2003) suggests that in South Africa, domestic water supply in rural areas needs to be prioritised by the local government. In rural areas of South Africa the use of water is not well documented. Also, rural people often do not pay for water collected from rivers or dams, and thus, it is difficult to establish exactly how much water is consumed by villagers. Due to poor water infrastructure and supply in rural areas, it is common for rural people to collect water directly from rivers, lakes and ground water resources. Such unmanaged water resources are vulnerable to draughts and pollution, and thus putting rural communities at risk of waterborne diseases and water scarcity.

3.6. Neoliberal reforms and access to water in South Africa

Pressure placed on the world's resources due to increased population and rapid economic growth has led to radical resource management strategies. The rise of the neoliberal logic in managing the world's resources is becoming an increasingly apparent feature in most countries. Water is a scarce resource and requires rigorous management strategies. Also, in most nations of the global south there is a problem of poor water infrastructure and delivery. Goldman (2007) argues that the World Bank proposed that neoliberal reforms such as the privatisation of water will tackle the problem of poor water management and inefficient water delivery in developing countries (Earle *et al.,* 2005; Goldman, 2007).

Liberal environmentalism is "a mode of resource regulation which aims to deploy markets as the solution to environmental problems" (Bakker, 2007: 431). In other words, free access to water is understood as the main cause of poor water management, resulting in

unsustainable water withdrawals. Under 'liberal environmentalism' water is treated as any other market item, the price and supply of water is determined by market demand. It is argued that treating water as a market item will deal with the wasteful manner in which water is often treated and, will encourage the clever and efficient management of water. Water was viewed as a free resource in most regions of the world and, it was often taken for granted (Earle *et al*., 2005; Goldman, 2007). Therefore, the introduction of 'liberal environmentalism' is seen as a way of ensuring that water is priced at its full environmental and economic cost. 'Liberal environmentalism' is based on the assumption that pricing water will result in improved water resource management. However, the formal industrial sector is the biggest culprit of poor water management. Due to the fact that large industries can afford the costs of water, there is very little transformation in how water is managed in the economic sector, specifically by large industrial businesses. Therefore, Liberal environmentalism only deprives poor domestic users and, does not address or change the water usage habits of the real causers of environmental degradation (von Schnitzler, 2008).

The 'liberal environmentalism' ideology has been contested by many who argue that water is a non-substitutable resource that is essential for human survival. Putting a price to water is denying the poor a right to life. The main argument that antagonists of 'liberal environmentalism' make is that water, unlike other resources, is not a standalone resource. Water is linked to other resources such as food and, also connected to human rights such as 'the right to health' and 'the right to life'. Therefore, denying people of water is denying them of their right to life, and thus, it is a violation of the first and most important human right (Bakker, 2007; Goldman, 2007).

The 'liberal environmentalism' ideology is gaining momentum in South Africa, manifesting itself in South African societies. Von Schnitzler (2008) makes reference to Igoli 2002, which was the neoliberal restructuring plan for the city of Johannesburg. This plan later led to the establishment of Johannesburg Water Pty (Ltd) a private company that took over from the state and, is now responsible for providing water and all water related services in the city of Johannesburg. After its takeover from the state, Johannesburg water then rolled out a plan to improve water management by upgrading water infrastructure and installing prepaid water meters in Soweto (South Western Townships) under a project called Gcini'amanzi (save water in Isizulu). The new prepaid water meters were met with antagonism from the

residents of Phiri in Soweto, where prepaid water meter systems were implemented. The resident of Phiri argued that prepaid water meters are an infringement of the right that every human being has to water. The concern raised by most residents of the township was that Phiri is a low-income poor residential area and most people cannot afford to pay for water. The implementation of the prepaid water meter system left many poor residents of Phiri without access to water. The prepaid water system was labelled as cruel and inhuman by protesters. Nevertheless, Johannesburg water, on the other hand, saw newly implemented prepaid water meters as a 'disciplinary technique'. Moreover, prepaid water meters were seen as a way of involving citizens in the conservation of water. Johannesburg water argued that prepaid water meters 'empowers the consumer' and prevents the accumulation of bad debt due to the fact that consumers can monitor their consumption and develop a culture of saving water (Bakker, 2007; Goldman, 2007; von Schnitzler, 2008).

Each household was entitled to free basic water of 6000 litres per month. Households that could not afford to pay for additional water often had to use unhygienic techniques in order to prevent going over the free basic water limit. Techniques such as flushing the toilet and washing dishes once a day are just some of the 'water saving techniques' that were used by the residents of Phiri (von Schnitzler, 2008)

3.7. Defining a sustainable livelihood

A livelihood, as explained by Chambers & Conway (1991) comprises of capabilities and assets. Capabilities are defined as the ability to perform activities required in order to generate a livelihood. Physical and social resources used to generate a means of living are called assets. A sustainable livelihood is achieved when the strategies used to gain a livelihood do not deplete available assets and capabilities. In other words, a sustainable livelihood makes use of available assets and capabilities, while enhancing and maintaining those very same assets and capabilities for future use.

Sustainable livelihood concepts are highly interlinked and cannot be understood in isolation. For instance, capabilities determine access to assets, and assets are meaningless without capabilities. Skills, knowledge, decision-making ability, good health, self-confidence and self-esteem, are all examples of capabilities. When capabilities are put into use the results are actions that enable access to assets such as food, clothing, education, social networks or

employment. When assets are available but the capabilities required to make use of available assets are lacking the assets become meaningless and thus cannot really be considered to be assets. Consider this example; if fish is abundant in a river, but what is lacking is the skills and knowhow on how to catch fish, the fish become meaningless to the livelihoods of people. If there is no capability, that is, the ability to catch fish, the fish (which is the resource) can serve no purpose in generating a livelihood. Furthermore, an understanding of what an asset or a capability is depends on people's perceptions and experiences. What people consider to be an asset is deeply rooted in the value system of every society or individual (Bebbington, 1999; Chambers and Conway, 1991; Mucavele, 2006; Niehof & Price, 2001; Scoones, 1998).

When capabilities and assets are exploited in the present, in a manner that secures a reserve for the future, sustainable livelihoods are achieved. Livelihoods are sustainable when there is a preservation of capabilities and resources. However, sustainability in itself is not only an end. Instead, sustainability is both a means to an end and an end in itself. In other words, using assets and capabilities sustainably creates conditions whereby livelihoods can be sustained in the future. The ultimate goal is sustainability but, sustainability can only be achieved through sustainable practices (Chambers and Conway, 1991).

Assets are broken down into two main categories; tangible and intangible assets. Tangible assets exist in the material realm and consist of produced, natural and human assets. Resources such as water, land, transportation, food and infrastructure are examples of tangible assets. Intangible assets refer to assets in the socioeconomic, political and cultural realm, such as education, access to information, social links and integration into a community, political participation and equity. *"Claims are demands and appeals that can be made for material, moral or other practical support or access"* and *"Access is the opportunity in practice to use a resource, store or service or to obtain information, material, technology, employment food or income"* (Chambers and Conway, 1991:8). The combination of different assets and capabilities results in specific livelihood strategies (Scoones, 1998).

The notion of sustainable livelihoods is not limited to a materialistic understanding of poverty, or a resource orientated approach to measuring sustainability, based on the

assumption that the possession of necessary capabilities and uninhibited access to required assets will automatically result in sustainable livelihoods. What such a conservative analysis misses is the personal, social and cultural meaning attached to resources and, how experiential social meaning will then influence interactions with resources. What outsiders consider to be essential and useful assets may not be viewed in the same light by insiders. Perceptions of poverty and wellbeing held by outsiders may clash with perceptions of poverty and wellbeing existing within a community, household or ideas held by individuals. Therefore, it is clear that understanding the social meaning attached to various resources is very important in effectively addressing the challenges in creating sustainable livelihoods. Culture, politics, economics and history are factors that are specific to every location, community, household and individual. Therefore, all those 'context specific' factors play an undeniable role in influencing very 'context specific' livelihood strategies. Choices in livelihood strategies do not only depend on the availability of assets and capabilities. That is, sustainable livelihoods are not merely achieved through creating what is falsely perceived by outsiders as 'ideal material conditions' for livelihoods to thrive (Chambers and Conway, 1991; Bebbington, 1999; Mucavele, 2006).

3.8. Using the rural livelihood framework of analysis.

The rural livelihood framework of analysis aims to determine the livelihood sustainability of a household, individual or community through the analysis of various aspects that make up a livelihood. More specifically, an assessment of the combination of assets and capabilities in a household and the role played by each asset and capability in generating a livelihood income is achieved using the rural livelihood framework of analysis. The framework seeks to analyse the political, historical, demographic, macro-economic, climatic, agro-ecological and social context to which a household is subject. A household cannot be understood without understanding the context in which the household is set (Pollard *et al.*, 2002; Scoones, 1998). The framework also aims to analyse the resource base of a household, such as natural capital, economic/financial capital, human capital or social capital, and to determine how such resources contribute to making the household sustainable.

A household is vulnerable to various external factors. Thus when assessing the household livelihood sustainability it is important to assess the household's ability to cope with

external factors. A sustainable livelihood, or rather, a sustainable household has the appropriate adaptation strategies to cope with external shocks and stresses. Therefore, the vulnerability, adaptation and resilience of households must be explored in order to establish whether or not livelihood strategies employed by households are sustainable, even under unfavourable conditions (Ellis, 2000; Scoones, 1998).

Natural resources that are crucial for domestic production in rural areas, for example, resources such as soil and water for subsistence agriculture may play a non-substitutable role for most rural households. Consequently, in the case of Borakalalo village where water scarcity is becoming an increasing concern, the livelihood of households in this village could possibly be under threat, more especially households that are unable to generate a livelihood apart from direct interactions with natural resources, specifically water in this instance (Bebbington, 1999; Niehof & Price, 2001; Scoones, 1998).

A household may perform well under favourable environmental conditions and collapse during environmentally challenging periods, such households may rely excessively on environmental resources. For example, child headed households may not have the ability to create meaningful employment, and thus, it could be argued that such households do not have a sustainable human resource base (Van Breda, 2010). As a result, child headed households may be more water-dependant than households that have a reliable and sustainable monetary income. Child headed rural households may be dependent on rural activities such as agriculture and livestock farming to generate a livelihood. A sustainable household is one that makes use of a variety of livelihood assets, so that in the failure of one asset, other livelihood assets can compensate for the failure of one. Making use of different livelihood assets and capabilities is referred to as livelihood diversification. A diverse livelihood does not only depend on one or a few assets or capabilities, but rather, makes use of a range of assets and capabilities to generate a livelihood (Bebbington, 1999; Ellis, 2000; Niehof & Price, 2001; Scoones, 1998).

The rural livelihood framework employs a holistic approach to analysing the livelihood sustainability of rural households. Therefore, trying to explore and understand the role that water plays in sustaining rural households cannot be done in isolation from other resources when using this framework. All resources of a household must be assessed in order to

determine whether or not a household is sustainable. In some rural households, water could play an essential role only with regards to domestic activities, while other household resources could be sufficient in generating a livelihood. Meanwhile, in other rural households similar to the example cited earlier, water may play a more productive and non-substitutable role in generating a livelihood income (Scoones, 1998).

This research made use of the holistic approach used in the rural livelihood framework to understand rural water usage in Borakalalo village. How a household interacts with water is influenced by how that household interacts with other resources. A household may have access to other important resources that are able decrease dependence on water. On the other hand, water may be the only channel that ensures access to other resources such as food or finances. Water is also used in small rural businesses (such as brewing and selling homemade beer, brick laying, running a small bakery or a car wash) that contribute an income in rural households (Pollard *et al*., 2002). In such cases, water plays a pivotal role in the household's ability to gain access to financial resources. Household livelihood resources are interlinked, and in order to understand a household's interaction with one resource, it is crucial that you also understand interactions with various livelihood resources. In other words, water cannot be studied in isolation, the interactions between rural households and water will only be understood when the interactions between rural households and other resources is also given careful consideration (Bebbington, 1999; Ellis, 2000; Niehof & Price, 2001; Scoones, 1998).

Chapter four: Empirical evidence

4. Introduction

The aim of this chapter is to present the results of the household survey that was conducted on 150 households in Borakalalo village. Each household that participated in this study had one household representative that was interviewed. Additionally, in some cases the interviews took the form of a discussion with more than one member of a household participating in the discussion. However, only one person was considered to be the main household representative even though the opinions of other members were not excluded in order to enrich this study. Allowing more than one household member per household to participate in this study provided clarity about different livelihood experiences that may exist in one household. All household representatives and other contributors were over the age of 18, and were permanent members in their represented households, as well as permanent residents in Borakalalo village at the time of this investigation.

There is a lack of knowledge about rural water usage. In order to understand how water scarcity affects rural livelihoods, it is pivotal for one to assess water usage trends of rural households. Having gained insight on the water usage patterns of rural households, the next step would be to evaluate how water-related activities that households choose to engage with in turn affect livelihood sustainability (Dlamini, 2007).

In order to bring forth light regarding the water usage patterns of households, this research explores past, present/current, and potential water usage patterns of households in Borakalalo village. Identifying past and present water usage patterns will reveal whether or not households in Borakalalo village have responded to the plight of water scarcity by altering household water usage patterns. Also, investigating possible water usage patterns will reveal whether or not there are water-related livelihoods activities that households in Borakalalo village wish to engage with, if water was readily available. More specifically, potential water usage patterns reveal whether or not water scarcity is a limiting factor in the choice of water-related activities that households engage with, and perhaps also a limiting factor in the livelihood options available to households in Borakalalo village.

Having singled out past, present and potential water-related activities, this research should then reveal how all the identified water-related activities contribute to livelihood sustainability. That is, this research seeks to do the following: take note of past, present and potential water-related activities. Compare past, present and potential water-related activities in order to reveal how water usage patterns are affected by water scarcity, and lastly, to uncover the relevance (or lack thereof) of identified water-related activities in sustaining rural livelihoods. Thus, revealing the effects of water scarcity on rural livelihoods in Borakalalo village (Soussan, 2003).

Measuring past water usage proved to be a challenging task in this project. Some households have past engagements with water-related activities, but discontinued participation long before water shortages became a reality for households in Borakalalo village. Therefore, it is important to note that those particular households made the decision to discontinue engagements with certain water-related activities long before households in Borakalalo village were faced with the challenge of water scarcity.

When measuring past water usage, all households that stopped engagements with water-related activities a year before the start of water shortages, were not included under the past water usage count. Initial ground truthing revealed that most households in Borakalalo village started experiencing periodic water cuts in early 2010. Furthermore, for some households, mostly upper-lying households, the water crisis escalated from periodic water cuts to permanent/prolonged water cuts. Worsening of the water crisis, from periodic water cuts to permanent/prolonged water cuts, began in early 2011, a year after initial periodic water cuts began in Borakalalo village.

4.1. Current and past water usage patterns in Borakalalo village

Kanyoka *et al.,* (2008) has identified what is called 'multiple uses' of water in rural areas. For the purpose of this research, multiple uses will be defined as different water-dependent or water-related activities that are evident in the water usage patterns of rural dwellers. In order to effectively meet the water demand in rural areas, it is important that the demands and usage patterns of the rural water consumer be interpreted. An understanding of 'multiple uses' of water would inform a more productive response to the water demands of rural dwellers. Henceforth, this section will explore the water usage patterns of households

in Borakalalo village (past, present and potential water usage) in order to unpack the reality of 'multiple uses' of water in Borakalalo. Tracking past water usage patterns will uncover how water has served the livelihoods of households in Borakalalo village in the past. Identifying current water usage patterns will reveal how water presently contributes to the livelihoods of households in this water scarce village. And finally, finding out what activities residents of Borakalalo village aspire to use water for will assist in identifying water-related livelihood activities that residents of Borakalalo could potentially use water for if it were readily available to them.

The respondents were asked to identify activities that represented households use water for. The responses given can be divided into four categories, namely: domestic use, agricultural use, livestock use and business use of water. Domestic water usage is characterised by the use of water within the house. Some few examples of domestic water usage include, cleaning cooking and bathing, also included under domestic use are some activities outside the house such as gardening or any other activity that is not productive. However, external uses of water pertaining to agriculture and livestock production do not fall under domestic use due to the fact that those two activities are classified as productive activities. Agricultural use of water refers to water that is used for agricultural production, normally referring to both commercial and subsistence agriculture. This research is looking specifically at households, and as a result will pay attention mainly to subsistence agriculture. Business use of water in a rural household context can be roughly defined as the use of water to support a small-scale rural business operation, either productive or service business operations. Livestock use of water is characterised by the use of water in tending to productive animals, this activity generally requires water in order to water and sustain livestock. This study focuses on subsistence livestock production (Mokgope & Butterworth, 2001; Butterworth *et al.,* 2003; Mokgope *et al.,* 2001).

All 150 respondents revealed that represented households currently use water for domestic purposes. A total of 55% of households (82 out of 150 households) currently use water for domestic purposes only, this is an increase from 39% (59 out of 150 households) under past water usage patterns. This shows that households have reduced the number of water-related activities that individual households choose to engage with. A decline is also observed in the use of water for agricultural purposes from 35% (53 out of 150 households)

under past water usage to 22% (33 out of 150 households) under current water usage. A reduction to 39% (59 out of 150 households) under current water usage, from 45% (67 out of 150 households) under past water usage, is also evident in the use of water for livestock production.

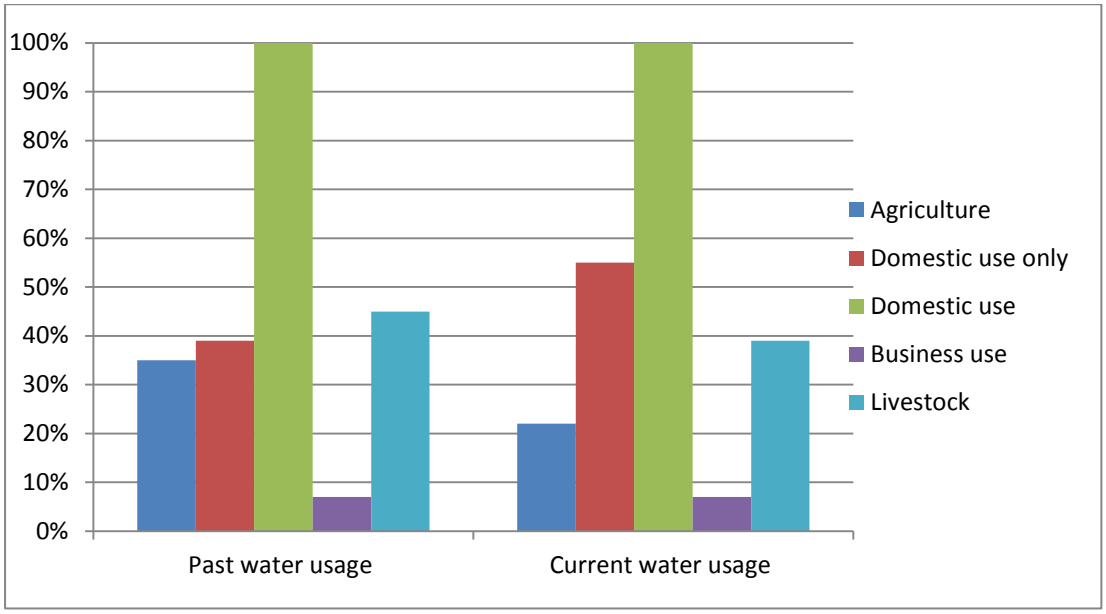

Figure 4: Past and present water usage patterns of households in Borakalalo village.

Households that chose to discontinue engagements with water related activities any time prior to 2010 were not included under past water usage. In this section past water usage only includes households that chose to discontinue engagements with water-related activities during the water scarcity period in the village, which is from 2010 to date. Nonetheless, it was not assumed that the current water shortage experienced in the village is the only reason behind the decision that some households made to discontinue interactions with water-related activities. This section will also explore some of the reasons that influenced the decision of some households to no longer engage with different water-related activities. Unpacking the reasons behind the decision made by some households to disengage with certain water-related activities, will reveal the extent to which water scarcity influenced the choice made by some households to cut back on water-related activities.

Respondents were questioned about their represented households' reasons for choosing to discontinue participation with some water-related activities. The reasons that were expressed by respondents were clustered into four categories. The first category is 'water shortages', and this category is inclusive of all factors that contribute to the households'

inability to access water for activities that the household previously engaged with. Factors such as: dirty and muddy water, broken and poor water infrastructure, distance from the water source, are all included under the 'water shortages' category (all factors limiting access to water are explored in greater detail under section 4.6). The second category mentioned by respondents is concerning 'time'. This category refers to limitations in the availability of time as a factor that caused households to no longer participate in certain water-related activities. 'Affordability' is the third category and, refers to the total monetary costs related to water-related activities. Some households could not afford the monetary costs of participating in some water-related activities, and thus, had to withhold household participation in those water-related activities. 'Affordability' concerns cost of inputs required for livestock and agricultural production or the capital and profit needed to maintain a water-related business. The last category is titled 'other reasons', this category includes all the other reasons for choosing to discontinue engagements with some water-related activities, these reasons are not concerned with the first three categories mentioned above.

Under livestock production households that stopped participating in this activity due to water shortages in the village total to 69% (46 out of 67 households). The total percentages are worked out from 67, which is the total number of households that have past engagements with livestock production. Households that no longer participate in livestock farming due to affordability issues total 13% (9 out of 67 households). Time is a direct cause of discontinuation in livestock farming activities for 12% of households (8 out of 67 households). While a total of 6% of households (4 out of 67 households) stopped participating in agricultural production for 'other reasons' not pertaining to affordability, time or water shortage issues.

Two of the 4 households that chose to discontinue participation in livestock production for other reasons not pertaining to; affordability, time or water shortage issues, state that their households chose to disengage with livestock production due to a lack of labour power. The quotations below explain the reason behind disengagements with livestock production:

"We didn't have a lot of cows to begin with, we only had three. But the few we had my son used to take care off. Since my son moved to Rustenburg to go work, we decided to sell those

cows. He was very upset about this, but three cows are not worth hiring a cattle herder for." (Respondent 58)

"We didn't have anybody to take care of our livestock since my father passed away, so we sold his cows. We didn't hire anybody because it was difficult to find someone we could trust, someone who would not take advantage of us because we are women. We feared that whoever we hire would steal from us because we don't know much about tending livestock." (Respondent 102)

One of the 4 respondents representing one of the 4 households that discontinued participation in livestock farming for other reasons not pertaining to water shortages, time or affordability shared the following:

"I had to sell my livestock so I could send my daughter to university." (Respondent 20)

The remaining respondent whose represented household no longer participates in livestock farming for 'other reasons' expressed the following concern:

"Theft is now a problem in the village. I had 10 cows that I bought after retirement and 4 got stolen. I was discouraged because it was 4 of the best I had, so I sold the rest. This didn't only happen to me, and it still continues to happen." (Respondent 87)

With regards to the use of water for agricultural purposes, all percentages are worked out from 53, which is the total number of households that have past engagements with agricultural production. A total of 79% of households (42 out of 53 households) no longer engage with agricultural production due to water shortages. Time limitations have caused engagements with agriculture to come to a stop for 10% of the households (5 out of 53 households). A total of 4% of the households (2 out of 53 households) no longer engage with agricultural production because of affordability issues. The remaining 7% of households (4 out of 53 households) no longer engage with agriculture for reasons not pertaining to water shortages, time or affordability.

Two of the four households that no longer engage with agriculture for 'other reasons' not concerned with water shortages, time or affordability revealed the following:

"We don't have anybody to work the field because youngsters finish school and go and seek employment outside the village. It's not like we don't need the agricultural produce, we still need it because these young people forget all about us and we suffer while they are driving fancy cars in the cities… Another reason we don't farm anymore is because there is no rain, it's not like before when the rain was more frequent." (Respondent 62)

"I'm not a young girl anymore and I don't have the strength to work on the field. These young people say that they will not be caught dead working on the field. They also say that farming is old fashioned, and that it's too hot for them to be slaving away in the heat. They forget that it's my slaving away in the heat that has put food on the table for them. They are full of empty pride." (Respondent 15)

The remaining two households shared that choosing to discontinue engagements with agricultural production was not influenced by anything specific, and that it was just a natural progression for their represented households to no longer engage with the activity. The two households expressed the following:

"We just stopped for no particular reason. I guess, we don't depend on the activity as much as we used to, so there was no longer any reason to continue with the activity" (Respondent 22)

"...the activity was no longer an asset to us so we stopped." (Respondent 83)

Table 4: Reasons for discontinuing engagements with different water-related activities

			Reasons for discontinuing participating in the water-related activity			
Water use	Percentage of past participants	Percentage of current participants	Water shortages	Time	Affordability	Other reasons
Livestock	45%	39%	69%	12%	13%	6%
Agriculture	35%	22%	79%	10%	4%	7%

4.2. Potential water usage patterns in Borakalalo village

Potential water usage refers to a representation of households that have expressed an interest in participating in other water-related activities, apart from the ones that individual households may currently participate in. Represented households may have previously engaged with the water-related activities of current interest to the households. Under this section, past water usage or past engagements with water-related activities is not measured according to time (unlike in section 4.1). Under section 4.1 the time of disengagement by a household with a particular water related activity influenced whether or not that household was included under the past water usage count for the abandoned water-related activity. The phrase 'abandoned water-related activity' is used to refer to a water-related activity that a household previously engaged with, but however, chose to discontinue engagements with that particular water-related activity. In this section, any household that has past engagements with a water related-activity, even before 2010 when the water crises began, will be included under past water usage count for the abandoned water-related activity. In addition, a distinction will be made between households that stopped participating in water-related activities of interest directly due to water shortages (from the year 2010) and households that chose discontinue participation in water-related activities for reasons not concerned with water shortages (before the year 2010).

The main concern here is not whether or not households have past engagements with water-related activities of interest. However, this section will reveal whether the interest expressed by households in water-related activities is new, or if the very same households that now express an interest in certain water-related activities are households that used to engage with those specific water-related activities in the past, and were perhaps forced to stop due to water shortages. This section will also be useful in revealing whether or not households that have stopped engaging with certain water-related livelihood activities still wish to engage with those specific activities, if water was readily available. Moreover, regardless of whether or not households have past engagements with water-dependent activities of interest, any interest expressed by all households in engaging with water-dependent activities was noted.

Under potential water usage, 3% of households (4 households out of 139) expressed an interest in using water for business purposes, if water was more readily available. The total percentage of households that expressed an interest in water-related business operations is worked out from 139. This total (139) is the total number of households that are currently not participating in water-related business, after subtracting the 11 households that currently engage with water-related businesses. All 4 household that have expressed an interest in water-dependent business are households that have not engaged with water-related businesses in the past.

A total of 20% of households (18 out of 91 households) would like to use water for livestock production. The total percentage of households interested in livestock production is worked out from 91 households. The total 91 excludes the 59 households that are currently engaging with livestock production. Moreover, 11% of households (2 out of 18 households) that have expressed an interest in livestock production are households that previously participated in this activity. One out of the two households that previously engaged with livestock production chose to discontinue participation specifically due to water shortages in the village (represented as WS on figure 4.1) while the one remaining household chose to discontinue participation in livestock production for other reasons long before the village started experiencing water shortages. It should be noted that percentages seen on figure 4.1 are worked out from 18, mainly because it is the total number of households that have expressed an interest in using water for livestock production. The remaining 89% (16 out of 18 households) of represented households expressing an interest in livestock production have never engaged with this activity before. These results seem to suggest that from the 46 households (69%) that claim that water scarcity is the reason why households chose to disengage with livestock production, only 1 of the 46 households view livestock production as a potential water-related activity of interest, if water was to be more readily available (refer to Table: 4 under section 4.1). Therefore, this poses a question a of whether the decision to discontinue engagements with livestock production was really water scarcity, more especially because only 1 household expressed an interest in practicing livestock production if water was readily available. These results contradict the results in section 4.1, where 46 out of the 67 households claim to have discontinued engagements with livestock production due to water scarcity. One would expect that these households would still have

some interest in participating in livestock production if water was readily available, especially because these households chose to discontinue engagements with livestock production because of water shortages experienced in the village.

Households that have expressed an interest in agriculture total to 25% (29 out of 117 households). The total percentage of households interested in agricultural production is worked out from 117 households. The total of 117 excludes the 33 households that are presently engaging with agricultural farming. A total of 14% of households (4 out of 29 households) that have expressed an interest in agricultural production are households that previously participated in agricultural production. Overall, 3 of these 4 households no longer engage with agricultural production due to water shortages currently being experienced in the village (note that percentages seen on figure 4.1 are worked out from 29 which is the total number of households interested in agricultural production). Only 1 household had stopped participating in agricultural production before water shortages became a reality in Borakalalo village. Therefore, the decision of 1 household to no longer participate in agricultural production was not as a result of water shortages in the village. A total of 86% of households (25 out of 29 households) that have expressed an interest in agricultural production are households that have no past engagements with this activity. Similar to the trend observed under livestock production, only 3 out of 42 households that claim that disengagements with agricultural production was as a direct result of water shortages, have expressed an interest in participating in agricultural production if water was more readily available.

Table 4.1: Potential water usage patterns of households in Borakalalo village

Potential water use	
Water uses	Percentage of households
Business use	3%
Livestock	20%
Agriculture	25%

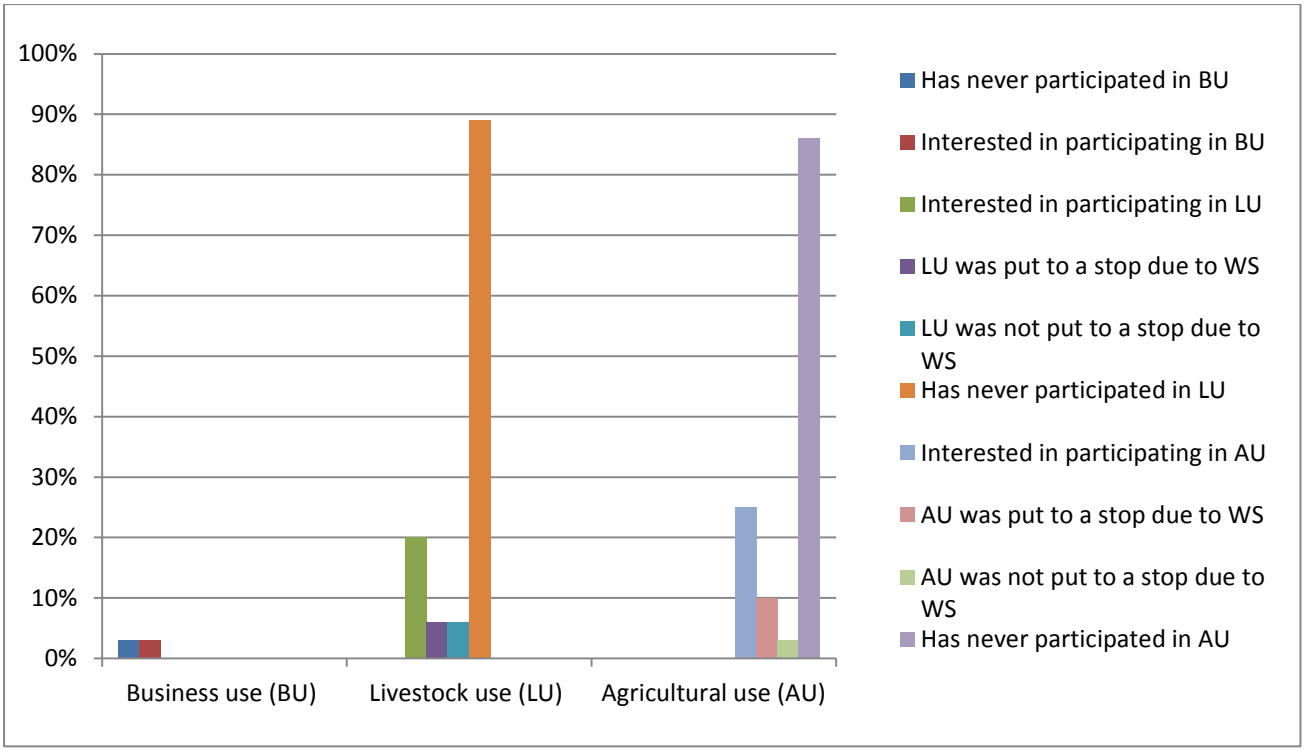

Figure 4.1: Potential water usage and the history of participation in water-related activities.

4.3. The effects of water scarcity on livelihoods in Borakalalo village

The previous two sections were dedicated towards revealing the water usage patterns, (past, current and potential water usage patterns) of households in Borakalalo village. In the previous two sections it was revealed that a change in the water usage patterns of households in Borakalalo village in response to current water shortages experienced is evident. Various reasons have been noted as the cause of changes in the water usage patterns of households in the village. However, water shortages have been the biggest contributing factor to changes in water usage patterns (as seen under section 4.1 on Table 4).

Having established that water scarcity has been a major cause of altered water usage patterns, the next section is dedicated to exposing the effects of water scarcity on rural livelihoods. In other words, now that we know that water scarcity has affected water usage patterns in the village, the next step is to look at how efforts that households have made to respond to water scarcity, mainly by changing water usage patterns, have affected household livelihoods as well as the overall quality of life for households in Borakalalo

village. This section will look at whether or not households in the village have been able to effectively respond to water scarcity.

Represented households were asked how they would rate their management strategies against water scarcity in different water-dependent activities that households engage with. The rating options were as follows: good, fair and poor. Good management strategies are those strategies that allow households to continue with desired water-related activities even though the village is experiencing water shortages. Fair management strategies are those management strategies that allow households to continue with water-related livelihood activities at the cost of other resources. For example, depending on water deliverers could be viewed as a fair management strategy, because although it may guarantee access to water, it may also have a negative effect on financial resources (the role of water deliverers is explored in greater detail under Section 4.5). Lastly, poor management strategies are those strategies that do not guarantee access to water and may also have a negative effect on access to other resources (access to food may become compromised and monetary income may become reduced).

Table 4.2: Water scarcity management capacity of households in Borakalalo village

	Water scarcity management capacity		
Activities affected by water scarcity	Good	Fair	Poor
Domestic use	5%	30%	65%
Agricultural use	11%	16%	73%
Livestock use	11.4%	14.3%	74.3%
Business use	40%	18%	42%

The results as expressed on table 4.2 include all households under domestic use because all 150 participating households continue to depend on water for domestic purposes. Domestic water usage trends have not changed under present and past water usage patterns. Under business use, only households that currently turn to water for business operations were included. The number of households that use water for business purposes has remained constant under past and current water usage patterns. Under agricultural and livestock use, households that are past and current users of water for agriculture and livestock are

included. Households that have never participated in livestock and agricultural production are not included under the water scarcity management ratings for livestock and agricultural water use. All households that have stopped participating in agricultural or livestock production due to water shortages will be automatically rated as having poor water scarcity management capacity for agricultural or livestock production (see table 4 under section 4.1 where represented households state reasons for discontinuing engagements with water-related activities). Also, households that formerly participated in agricultural and livestock production, that have not made reference to water scarcity as the reason behind choosing to discontinue engagements with crop or livestock production, are not included in the water scarcity management ratings for those particular water-related activities. All other households that still engage with agricultural or livestock farming were able to freely rate the represented household for those specific water-related activities.

A total of 65% of households (97 out of 150 households) rated their water scarcity management strategies under domestic water usage as poor. A total of 8 out of 150 households (5% of households) rated their water scarcity management capacity under domestic water usage as good, while the remaining 30% of households (45 out of 150 households) rated as fair.

Under agricultural water use, it is important to note that the percentages are worked out from a total of 75 households. The total of 75 households is made up of the overall number of households that presently engage with agricultural production (33 households) and only the total number of households that made reference to water scarcity as the reason behind choosing to discontinue engagements with agricultural production (42 households). Households that have past engagements with agricultural farming but, however have not decided to stop participating in the activity due to water scarcity are not included in these ratings. Additionally, all households that have never engaged with agriculture are also excluded from these ratings. A total of 53 out of the 86 households (62%) that either have past or present (33 present users) engagements with agricultural production no longer participate in agricultural production. Thus, 53 households are classified as past users of water for agricultural purposes. Furthermore, a total of 42 out of 53 households that discontinued engagements with agricultural production stated that the reason behind disengagements with crop production was water scarcity. Therefore all 42 households that

are former participants in agricultural farming but, no longer participate in this activity due to water scarcity are automatically rated as having poor water scarcity management capacity under agricultural use. An additional 17% of households (13 of 75 households) are also rated as having poor water scarcity management capacity under agricultural use, as rated by household representatives. Overall, the total percentage of households that rate as having poor water scarcity management capacity under agricultural use is 73% (55 out of 75 households). A total of 11% (8 of 75 households) of households rated as having good water scarcity management capacity, and 16% (12 out of 75 households) rated as having fair water scarcity management capacity under agricultural use.

Under livestock use, a total of 46 out 67 households that formerly participated in livestock herding have chosen to stop participating in the activity specifically because of water scarcity. As a result, these 46 households are automatically included under households that have poor water scarcity management capacity under livestock use. In addition to the 46 households that are automatically rated as having poor water scarcity management capacity, another 30% (32 out of 105 households) is added. However, the 30% of households added represents households that were rated by the household representatives. The number of households rated as having poor water scarcity management capacity under livestock production total 78 out of 105 households (74.3%). Households that have good water scarcity management capacity under livestock use total 12 out of 105 households (11.4%). Households that have fair water scarcity management capacity under livestock use total 14.3% (15 out of 105 households). The total percentages are worked out from 105 households; this total is made up of 46 households that previously engaged with livestock production, but nonetheless, engagements with livestock production have come to an end specifically because of water scarcity and 59 households that currently engage with livestock production are also included into this total.

The number of households that use water for small-scale business purposes total 11 households out of 150 households, this total has remained constant for past and current water usage. Therefore, the percentages are worked out from a total of 11 households and, none of the 11 households were automatically rated. A total of 42% of the households (5 out of 11 households) that use water for business purposes rated as having poor water scarcity management capacity under business use. Households that rated as having good

water scarcity management capacity under business usage total 40% (4 out of 11 households). Households that rate as having fair water scarcity management capacity under business use of water came to a total of 18% (2 out of 11 households). None of the households were automatically rated as having poor water scarcity management capacity under business use, mainly because the number of households that use water for enterprise purposes has remained constant. Furthermore, the number of households that rate as having poor water scarcity management capacity under business use is somewhat concerning, mainly because it suggests that in the long run (if current water shortages in Borakalalo village are not addressed) these water-related businesses stand the risk of collapsing.

Respondents were also asked to elaborate on the different ways in which water scarcity affects their represented households. The results were grouped into various clusters, namely: reduced household financial income, time wasted due to inability to access water, businesses productivity is negatively affected, health and hygiene are negatively affected, food security is negatively affected, livestock investment is negatively affected, damage is caused to personal property and domestic activities are negatively affected. Table: 4.3 represent the effects of water scarcity on households in Borakalalo village in greater detail.

Table 4.3: The effects of water scarcity on households in Borakalalo village

Effects on livelihoods	Percentage of households
Reduces household income (due to paying water deliverers)	4%
Accessing water is now a time consuming task	39%
Affecting Businesses	7%
Affecting hygiene	19%
Affecting food security	30%
Affecting livestock investment	37%
Increased stress levels	52%
Damage to geysers	3%
Affecting domestic activities	89%

4.4. Level of importance/non-importance of different water-related activities in sustaining livelihoods in Borakalalo village

Rural households engage with different water-related activities for various reasons. Conventional rural livelihoods theories present some ideas of rural activities that are important for sustaining rural livelihoods. However, what most rural households consider as crucial livelihood activities and what rural livelihood theories view as crucial livelihood activities may not necessarily be identical. Some households may choose to participate in an activity for traditional reasons. For instance, activities such as livestock and agricultural farming bear a lot of cultural significance for rural dwellers (Swanepoel *et al*., 2010). As a consequence, the decision to participate in such activities may not only be influenced by livelihood income requirements, but rather, by cultural practises. Even so, most rural livelihood theories may view livestock and agricultural farming as activities that are crucial for rural livelihood sustainability. Therefore the clash between what rural households view as crucial livelihood activities and, what the current theoretical framework around rural livelihoods perceives as crucial livelihood activities is evident (Bebbingtoon, 1999).

Considering this, the respondents were asked to rate the level of importance of water-related activities in sustaining household livelihoods.

The respondents were asked to rate the level of importance of different water-related activities in sustaining household livelihoods. Once again the different water-related activities were clustered into four categories: livestock farming, agricultural farming, business use and domestic use. The rating options were as follows: not important, important, very important and seasonally important.

When a water-related activity is rated as 'not important' by a household, this means that the household does not consider that activity to be essential for the sustenance of the household's livelihood. Households that rate a water-related activity as 'important' consider that activity to be beneficial for the household, in other words, the activity makes a meaningful contribution to the households' livelihood income. At the same time, an activity considered to be important is replaceable and, when an activity rated as 'important' is threatened households have the capacity to diversify into other income generating activities. Subsequently, households are able to continue without participating in activities rated as 'important'. However, even though the household is able to survive without an activity that is rated as 'important' to the household's livelihood, the survival of this household without that particular activity will put pressure on other resources in order to compensate for the loss of the abandoned water-related activity. Water-related activities that are rated as 'very important' by a household are irreplaceable, if the activity had to come to a stop livelihoods would collapse. There are also water-related activities that have 'seasonal importance' for households, such activities are only important for households during specific periods/seasons (Campbell *et al.,* 2003).

All 150 respondents view water-related domestic activities as 'very Important' for livelihood sustainability. Moreover, all households that use water for business purposes (11 out of 150 households) rate water-related business operations as 'very important' for sustaining household livelihoods.

Agricultural production is considered to be 'very Important' for sustaining household livelihood by 30 out of 150 households (20%) while 54 out of 150 households (36%) rate agricultural production as 'important'. It is crucial to note that the total number of

households that consider agricultural production to be ‘important’ for sustaining household livelihood is more than the total number of households that currently participate in agricultural production (33 households currently participate in agricultural production). These results correspond with the results under potential water usage (section 4.2 in figure 4.1) where more than 20% of households that are currently not engaging with agricultural production expressed an interest in this particular water-related activity. This shows that a significant number of households value agricultural production as an ‘important’ activity for sustaining rural livelihoods, even though those particular households are not currently engaging with agricultural production. For a total of 15 out of 150 households (10%) agricultural production carries ‘seasonal importance', and a total of 51 out of 150 (34%) households view agricultural production as ‘not important’ for livelihood sustainability.

With regards to livestock farming, the results show that 42 out of 150 households (28%) value livestock farming and view it as an ‘important’ activity for livelihood sustainability. Unlike in the case of agricultural farming, there are fewer households that view livestock farming as an ‘important’ livelihood activity than there are households that currently participate in livestock production (59 households currently participate in livestock farming and only 42 view it as important). A total of 12 out of 150 households (8%) rated livestock as ‘very Important’ for sustaining household livelihoods, while a total of 78 out of 150 households (52%) consider livestock farming as ‘not important’ for sustaining household livelihoods. Finally, for 18 out of 150 households (12%) livestock farming is an activity of ‘seasonal importance’.

Table 4.4: The level of importance/non-importance of water-related activities in sustaining rural livelihoods

	Past and current usage patterns		Level of importance or non-importance of water-related activities in sustaining rural livelihoods			
Activity	Total percentage of current users	Total percentage of past users	Not important	Important	Very important	Seasonal importance
Livestock farming	39%	45%	52%	28%	8%	12%
Agricultural farming	22%	35%	34%	36%	20%	10%
Business use	7%	7%	0%	0%	7%	0%
Domestic use	100%	100%	0%	0%	100%	0%

4.5. Water-dependent businesses and the rise of water scarcity dependent businesses in Borakalalo village

Under current water usage patterns of households in Borakalalo village, it came to light that 11 households out of the 150 households that were surveyed (7% of households) are households that are using water for small-scale business purposes. Also, under potential water usage it was revealed that 3% of households that are currently not using water for small-scale business purposes (4 households out of 139) expressed an interest in doing so. The aim of this section is to explore the types of water-related businesses that households in Borakalalo village engage with, as well as the water-related businesses that households aspire to engage with. This section will also explore the rise of water deliverers/water vendors, a water scarcity dependent business that has emerged as a response to market demands caused by water scarcity in the village.

Water scarcity has reduced the profitability of small-scale rural businesses in Borakalalo village. Ensuring a constant water supply for business operations is a challenge. At the same time, water scarcity has opened up new business ventures for water deliverers. Some people in the village who own some form of transportation have seen current water shortages experienced in Borakalalo village as a business opportunity. Hence there are water deliverers in the village who deliver water to households and, water-dependent

businesses in exchange for money. Water deliverers take the burden of having to search for water all over the village for many who simply do not have the physical capacity or tangible resources to do so (such as elderly people who live by themselves or households without efficient transportation).

Securing a water supply has become a daunting task for many households in Borakalalo village. Jojo water tanks are sometimes empty and therefore unreliable. As a consequence, households that depend on water tanks may have to find the nearest running tap when Jojo tanks are empty. The challenge of empty water tanks is a challenge facing mainly high-lying households that have gone without a constant supply of running tap water since early 2011, and thus dependant mainly on water tanks. Despite this, some households in high-lying areas that have the transportation needed to collect running tap water from low-lying areas do so, and choose not to make use of water from Jojo tanks. Households that choose not to make use of water from Jojo tanks have expressed dissatisfaction towards the quality of water from this source. There are also households without transportation that have expressed distrust towards water from Jojo tanks, and it is mainly these households that make use of the services offered by water deliverers. Some households use water from Jojo tanks for cleaning, bathing and other domestic activities, but may depend on water deliverers for water that is physically/orally consumed. Most elderly people do not have the physical strength required to collect water even from the nearest water tank, hence elderly people tend to rely heavily on water deliverers.

The above mentioned cases do not represent all households that make use of water deliverers. Households that can afford the service only when the situation requires seldom make use of water deliverers, but nonetheless, such households may call on water deliverers for other reasons apart from the following: distrust towards Jojo tank water, empty Jojo tanks, and the inability to physically collect tap water. Some household representatives stated that their represented households do not normally make use of water deliverers unless the household is having a wedding ceremony, a funeral or any other cultural/religious ceremony that may require a constant supply of water.

When most of the Jojo tanks, community taps and in-dwelling taps are dry, the people of Borakalalo village refer to such times as ‘Paka tsa fa go omile gotlhe-gotlhe’ (A Setswana

expression meaning ‘absolutely dry times’ in English). Although most households try to plan ahead by securing an emergency water supply for ‘absolutely dry times’, there are still some households that may not be prepared, and as a result may turn to water deliverers during such times. Water deliverers then collect water from other villages, or other sections of Borakalalo village that may not be ‘absolutely dry’. ‘Absolutely dry times’ last for three days at most and occur once approximately every three to four months. Some household representatives expressed the following sentiments:

“I don’t make use of water deliverers a lot really. I just use water from the Jojo tank, and it hasn’t done anything to anybody in our household thus far, so we don’t think there is anything wrong with that water. I suppose at the end of the day it’s also a matter of preference. We only used water deliverers for my daughter’s wedding because we needed a constant supply of water. The people in the village were going to complain if we relied on the community Jojo tank for the wedding, and besides, we needed a lot of water so we made use of water deliverers. I also use water deliverers when we are experiencing ‘absolutely dry times’ because I never plan ahead.” (Respondent 13)

“Sometimes luck works against me. A day before or so, I would use water from my emergency water supply for ‘absolutely dry times’ and then the very next day we start to experience ‘absolutely dry times’ when my water supply is running low, that’s when I will make use of water deliverers.” (Respondent 116)

“I think these Jojo tanks are dirty inside, nobody ever comes to clean them, even my water barrel at home must be cleaned inside once in a while, but these Jojo tanks never get cleaned. I don’t trust that water so I don’t drink it or cook with it. I only use it to bath and to clean.” (Respondent 72)

It is evident that water deliverers noticed a gap in the rural market and, went on to fill the gap by delivering water to those in need of the service. Therefore, it can be argued that the business operation of delivering water depends on the continuation of water shortages in Borakalalo village. In other words, delivering water is a water scarcity dependent business, and in order for the business to continue operating water scarcity must continue to challenge access to water for households in Borakalalo village. Water scarcity has opened a

business opportunity that would otherwise not exist if water shortages were not posing a threat to household access to water in Borakalalo village.

A total of 11 out of 150 households (7%) currently use water for business operations. Not all water-dependent businesses that were discovered in this survey are owned by the main respondents. Only 4 of the 11 water-dependent businesses (36%) are owned by the main respondents, and the remaining 7 of 11 businesses (64%) belong to other members of the represented households. Nonetheless, these small-scale businesses contribute to livelihoods. Water-dependent businesses that were mentioned in the survey are as follows: cooking business, hairdressing (hair salon) making and selling home brewed beer, gardening services, preparing and selling wild spinach (Morogo) selling pot plants, car wash, tavern, producing and selling clay pots, producing and selling Makatane jam, and a construction business. Only the construction business and the tavern are formally registered businesses, the remaining businesses fall under the informal economy. Moreover, 5 of the 11 water-related businesses noted in this investigation are female-owned and operated businesses. The hair salon, the Morogo business, the cooking business, the beer brewing business and the jam making business are all female-owned and operated businesses.

The cooking business operates as follows; the food is cooked at the owner's home and then sold to school children at Borakalalo Primary School. The business owner reports that water scarcity has affected the business, and has in some cases reduced profits. There have been instances when food had not been cooked due to water cuts, thus business was affected and had to be put on hold for a day or so. Although the owner tries to plan ahead for water cuts, there have been times when the service offered by water deliverers has been required. Water deliverers, no matter how helpful they may be to business owners, are an added cost to everyday business operations, and therefore, an unwelcomed expenditure for small businesses. The owner of the cooking business shared the following:

"My business is small and I don't make a lot of money. I'm competing with other people who sell food at the school. When I pay water deliverers, I lose money that I don't have because every cent counts when you are running something this small. This business is for the survival of my family, so every cent counts. When I lose money because I couldn't sell for a day or so, because I didn't have water and couldn't cook, my business suffers. When my business

suffers my family also suffers. Like I said, I try to plan ahead as much as I can to avoid losing money, but sometimes my planning is not enough and then I pay the price." (Respondent 111)

Amaranth, also known as Morogo in Setswana is traditional wild spinach indigenous to Southern Africa. Morogo is a traditional dish that makes up a significant part of the diet of many people in Borakalalo village. Most, but not all types of Morogo, grow naturally as part of the Southern African flora and fauna. The word Morogo may also be used to refer to all different forms of green leafy vegetables that do not fall under the wild spinach category. Examples of green non-wild vegetables that fall under the morogo category include: pumpkin leaves, beetroot leaves, bean leaves, cauliflower leaves, cabbage and lettuce. Wild Morogo plants are indigenous to Southern Africa, and therefore can survive under very dry conditions (van der Walt *et al.,* 2009). However, this small agricultural business operation is still very dependent on the availability of water, especially for non-wild Morogo. Once the Morogo is harvested it is then washed, cooked to prevent it from rotting (both processes require water) then dried, packaged and sold. In some instances nonetheless, Morogo is only washed and sold as soon as possible in its fresh condition. Therefore, the small Morogo operation is also challenged by water scarcity:

"There have been days when I've had piles of Morogo just waiting to be washed, cooked, packaged and sold, but because there is no water there is also no business. After a few days I have to throw the Morogo away because it is already old and has dried up. I can't sell it because my customers will complain and I will start to lose them. I lose, time, money and labour, everybody is losing because people need to eat." (Respondent 141)

A business offering gardening services to households in Borakalalo village has pointed out that water scarcity has shifted the priorities of many residents of the village, and as a result, people now prioritise water for other activities and not for gardening. People in the village are not as concerned as they previously were about the state of their gardens, mainly because they do not have water to spare for gardening activities. At times, even the few clients that still remain committed to making use of gardening services expect the gardening service provider to secure water required for this activity:

"My father has lost a lot of clients since this whole water issue started. People don't care about their gardens anymore. Everything is brown now in the village, people don't have the water required to water their lawns and their plants. The few clients that he still has ask him to bring his own water. The problem is that bringing his own water causes him to charge more, and then the clients say it's all getting too expensive and start talking about paving the whole yard. You see, that's how he loses clients." (Respondent 3)

Without water it is impossible for a car wash business to operate. The respondent representing 'X car wash', shared about some of the challenges posed by water scarcity to this business. The car wash is owned by three people from different households, and therefore, this business is a source of income for three households. However, only one of the three households drawing from income generated at this particular car wash was included in this study.

'X car wash' is strategically located near one of the biggest local taverns and a local *'*Shisanyama*'*, the word 'Shisanyama*'* means 'Braai meat' in South African slang. A Braai is the Afrikaans word meaning barbeque or grill, and a *'*Shisanyama*'* is a restaurant that specialises mainly in barbequed/grilled meat (Gill, 2012). Although the household that represents the *'*Shisanyama*'* was not included in this study, the effects of water scarcity on this business were expressed through other respondents. All these three businesses, the tavern, the 'Shisanyama' and the car wash, depend on each other. These are some of the concerns shared about the effects of water scarcity on the above mentioned businesses:

"They connect a hose to the community tap and make use of that water. Some people used to complain about them connecting their hosepipe to a tap that doesn't belong only to them, but many people don't have a problem with this and just get water from the hosepipe. It's not like the pipe is preventing water from coming out. During 'absolutely dry times' even that community tap runs dry, during those days they have to close shop, because what can they do if there is no water? They just see their customers driving all the way to Gopane village to wash their cars there. It breaks my heart because they are losing money." (Respondent 19)

The owner of one of the local taverns shared the following:

"This tavern is big, the biggest in Lehurutshe. People like to come here because they love Borakalalo village and its people. We are a people without a chief really, or maybe we have one and just refuse to be ruled, I'm not sure. We do as we like, we party till late, open for business on a Sunday and play our music louder than the local church. Nobody can tell us anything, we can't be ruled and people love that about us. People come from Botswana, Pretoria, Rustenburg and even Jo'burg to come party with us. People choose this tavern over a fancy club in Melville. The problem now is that when the toilets can't be flushed because there is no water people don't come. Some ladies won't be caught dead using the toilets outside, but the guys come anyway. But you see, when there are a few women the money is slow to come out. I'm sometimes forced to close the toilets and it just makes people angry and they leave. I think that, above everything this is the biggest problem. It also affects the car wash next door, because for some reason drunken people like to have their cars clean. When people are waiting for their cars to be washed they come in here for a beer or two, some may go to the 'Shisanyama' and braai some meat. Some people come to the 'Shisanyama' and decide that they'd like a beer to go with their meal and so they come in here. The people would be in here drinking while outside, their cars are being washed, and their meat is getting ready at the 'Shisanyama'. So you see, I need the car wash and the 'Shisanyama', and without them I suffer and without me, they suffer too. At the end of the day, when there is no water we all feel the pain." (Respondent 147)

Makatane in Setswana and Wartlemoen or Waatlemoen in Afrikaans is an indigenous African fruit belonging to a family of climbing plants which includes gourds, melons, gherkins, cucumbers and loofahs. The national research council argues that this plant is good for fostering rural development due to the fact that it is easy to grow and sell. This adaptable plant has the ability to survive even under very hot and dry climatic conditions. The production and selling of indigenous African plants is a source of income for many rural dwellers in Africa, and Borakalalo village is not an exception (National Research Council, 2008; Shackleton *et al.,* 2000). However, when faced with the threat of water scarcity, businesses that make use of indigenous fruits are also threatened. In Borakalalo village one such business makes use of Makatane, an indigenous fruit, to produce and sell homemade jam. The jam is not only sold in Borakalalo village but is also sold to neighbouring villages,

towns and cities in and out of the province. The challenges encountered by this business are expressed below:

"It's mainly hygiene issues that are the biggest concern for me when I'm running short of water. On days when I don't have enough water, I prefer not to work or I make use of water deliverers. This all affects my business because sometimes I lose time and money." (Respondent 36)

For 1 out of the 150 household that participated in this study, brewing and selling beer is a small business operation that generates a modest income. The respondent that represented the household that engages with this business operation expressed the following:

"Of course the business is affected by water scarcity. How else can we brew beer without water? Sometimes people come early in the morning to come and drink, and we have to turn them away because there was no water the previous day and we had not brewed any beer at all or have not brewed enough." (Respondent 127)

One of the local hair dressing businesses also complains that water scarcity limits the number of clients the business gets:

"People go to Zeerust to go do their hair, during 'absolutely dry times' especially, it cost R50 return to go to Zeerust. I try and make use of water deliverers where I can. Sometimes I get a barrel of water from water deliverers and then I only get two to three clients. It's not always worth it, this is a village, and we don't get people queuing up every day to do their hair. Business is booming at month end, and when I don't have water during those times. It slows me down and I lose clients because people are impatient at month end, they've got bills to pay." (Respondent 92)

Having to sell pot plants to people who don't always have the water to maintain those plants can slow sales down. This is just one of the ways in which water scarcity affects this small scale rural business. Expressed below are some of the trials encountered by this small-scale rural business:

"The business is water-dependent because who is going to buy pot plants if there is no water? When the pot plants are still under my care, I have to care for and maintain them, so

I need water and these water shortages just make everything even worse for our small and struggling businesses." (Respondent 13)

The clay pot producing business experiences the following challenges*:*

"It's a challenge. I can't really explain it, but try handling clay with no water. And without actually realising, it slows down productivity. You must remember that I sell these pots as far as Potchefstroom, and people kill for these traditional pots. Not a lot of people can make pots like this. I have some competition from people from Botswana who are just as skilled with their hands as I am." (Respondent 60)

The construction business expressed the following challenges:

"It's mainly a productivity issue. I would be able to do more if water was readily available, but unfortunately that's not the case. I just have to make other means to get water and make sure that I'm never dry, and sometimes that's not possible and productivity slows down." (Respondent 187)

Under potential water usage it is revealed that 3% of households that are currently not using water for small-scale business purposes (4 households out of 139) express an interest in doing so. The businesses of interest are as follows: a crèche, a small Laundromat, fish and chips cafe and cleaning services. Views raised about potential water-related businesses were as follows:

"I want to buy these big washing machines and start a Laundromat. It would not only service this village but other surrounding villages. If water was not such a problem, that's a business that I would like to start." (Respondent 21)

"Do you know how long the queue at fish and chips cafe in Zeerust is? That queue is not only filled by locals, it's filled by people from Borakalalo and surrounding villages. I honestly want to bring that kind of business to the village. We have a big market here for that if I find a location that is convenient for even the surrounding villages. It costs R50 to go to Zeerust by taxi, including the return fee, so people will be saving money. Now a lot of us have these business ideas, but fear that our businesses will collapse because of water scarcity.

Borakalalo is a growing village, it has a lot of potential to develop because of its location and its liberal ways, the only problem is that we have no water." (Respondent 9)

"I want to open a crèche where we teach the children in English instead of Setswana. All these other crèches teach in Setswana so mine would be different. However, this whole water issue makes me think twice about the idea. I think now is not the right time, we are being promised that this whole water thing is about to be resolved. I hope that it won't take more years because they have been promising that its being resolved since it started." (Respondent 59)

"There are lots of people in the village who own houses here but work elsewhere and they only come home a few times in a year. Most of these people need people to care for their houses while they are gone. I want to be able to clean these people's houses and have them pay me. I also want to clean these supermarkets, and they need my services because people are complaining." (Respondent 11)

4.6. Challenges in accessing water and various disturbances caused to the main water supply of households in Borakalalo village

This section will explore the different water sources that residents of Borakalalo village currently depend on during present water shortages in the village. Residents of Borakalalo village previously depended mainly on piped water from either community taps or in-dwelling taps. Some residents of the village who do not currently have access to piped water from in-dwelling or community taps make use of Jojo water tanks that have been strategically placed at different locations in the village, mostly in high-lying sections of the village.

All 150 respondents have pointed out that their represented households depend on more than one source of water because there is currently no reliable water source that households can depend on at all times. For example, if the nearest Jojo tank is empty, some residents may be forced to walk or drive to what residents may consider as different sections of the village from where dwellings/homes are located. At times residents may even turn to water deliverers. It is in low-lying sections of the village, where there is currently piped water supply, that some residents from high-lying sections of the village go in search of water from community taps (even though piped water supply is also interrupted

at times in low-lying sections of the village). Residents of high-lying sections of the village who depend mainly on Jojo tanks will turn to community taps in low-lying sections of the village when Jojo tanks are empty. In addition, residents who experience periodic water cuts and depend mainly on tap water either from the nearest community taps or from in-dwelling taps may turn to other water sources such as Jojo tanks or water deliverers when experiencing piped water cuts (mainly residents in low-lying sections of the village experience periodic water cuts).

Piped water is highly undependable, and thus, in order to secure a constant water supply, a lot of households often have to turn to more than one water source. This makes it difficult to pin point the present main water source for most households in Borakalalo village. Households depend on various sources depending on what the situation requires at that time. For instance, a household that relies on tap water from an in-dwelling tap may be forced to turn to a community tap in another section of the village for a day or two due to sudden water cuts in that particular section of the village. Securing a constant supply of water is an unpredictable chore for residents of Borakalalo village. Some households have their own private Jojo tanks in order to secure a constant supply, while some households may turn to neighbours owning private Jojo tanks for water during dry days.

There are households, mostly in high-lying sections of the village, that experience prolonged water cuts for months, and then suddenly those high-lying households may have running tap water in their yards or the nearest community tap for a few days. A household that only has running water for a day or so, once in three months, may see this as an opportunity to store up on tap water, depending on whether or not the household has the means to do so. It is mostly households that own Jojo tanks that are most suited for storing water. Nonetheless, even households that do not have storing capacity as great as that of a Jojo tank take full advantage of the opportunity to store up on water, making use of large buckets and barrels. Despite it being complicated, this section will attempt to reveal the water sources that households consider to be presently serving as the main source of water for represented households.

Overall, a total of 20 out of 150 respondents (13%) said their represented households rely on Jojo tanks and community taps in a section of the village that they consider to be their

own. An additional 15 out of 150 households (10%) depend mainly on Jojo tanks and will turn to other sources only when Jojo tanks are empty. A total of 5% of households (7 out of 150 households) make use of community taps in what they consider to be another section of the village. Meanwhile, a total of 35% of households (53 out of 150 households) currently have running water inside their yards, and are dependent on in-dwelling taps as the main source of water. Community taps, in a section of the village that the respondents consider to be their own, are a main source of water for 34 households out of 150 households (23%). At total 10 out of 150 households (7%) get water delivered by water deliverers, and 6 out of 150 households (4%) depend on both water deliverers and community taps (from a section of the village that they consider to be their own). Some 5 out of 150 households (3%) depend on in-dwelling taps, but also turn to water deliverers when necessary.

Appendix 5 in page 192 is a map that was compiled by Statistics South Africa based on data collected in this research project. The map illustrates access to running tap/piped water in Borakalalo village. Tap water is accessed either through in-dwelling or community taps (through the nearest community tap, a community tap in other sections of the village or a community tap in neighbouring villages). The red dots on the map represent households that did not have access to tap water at the time of this investigation, while the blue dots represent households that had access to tap water. Overall red dots are concentrated mainly in high-lying areas of Borakalalo village. Red dots in upper-lying sections of the village mainly represent households that are experiencing prolonged water cuts. Although there are also red dots in low-lying sections of the village, most households in low-lying sections of the village only experience periodic water cuts. In some cases, a red dot is directly next to a blue dot, this is because households were surveyed on different days. For example, if a section of the village experiences periodic piped water cuts on the day some household in that particular section of the village were surveyed, households surveyed on that specific day would have been noted down as households that do not have access to piped water. However, if on the next day more households are surveyed in the same section of the village that was surveyed the previous day, and on this particular day piped water supply had been restored, households surveyed on this day would have been marked as households that have access to piped water. Therefore, this map does not only show household access to

piped water in Borakalalo village, instead, this map also serves as evidence of the temporal and spatial variability of water scarcity in Borakalalo village.

There are various disturbances to piped water supply in Borakalalo village. Residents of the village have identified the following challenges that cause disturbances to the piped water supply: piped water cuts (periodic water cuts or prolonged/permanent water cuts) muddy water, broken community taps and empty Jojo tanks. The participants were asked if their represented households ever experience any kind of disturbance to what the household presently views as the main water supply. All 150 respondents said that represented households have experienced some form of disturbance to their main water supply. The responses were as follows: 39 out of 150 households (26%) have had the experience of having muddy tap water, 87 out of 150 households (58%) have experienced periodic water cuts that last for about two weeks at most, 63 out of 150 households (42%) experience prolonged water cuts that last for a month or more, 20 out of 150 households (13%) have experienced a disturbance to the household's main water supply caused by damaged community taps, and empty Jojo tanks have posed a challenge to the water supply of 29 out of 150 surveyed households (19%).

Table 4.5: The different water sources that represented households in Borakalalo village depend on

Water source	Number of households	Percentage of households
Jojo tanks and a community tap in section of the village I consider to be my own.	20 households	13%
Mainly a Jojo tank, unless it's empty.	15 households	10%
Mainly a community taps in other sections of the village that I do not consider to be my own , unless there is a piped water cut	7 households	5%
Mainly an in-dwelling tap, unless there is a piped water cut.	53 households	35%
Mainly a community taps in a section of the village I consider to be my own, unless there is a piped water cut.	34 households	23%
Mainly water deliverers, unless I'm able to access water independently from water deliverers.	10 households	7%
Mainly a community tap, in a section of the village I consider to be my own and, water deliverers.	6 households	4%
Mainly in-dwelling tap and water deliverers	5 households	3%

Table 4.6: The different challenges that threaten main water supply of represented households in Borakalalo village

Type of disturbance to piped water supply	Number of household	Percentage of households
Muddy tap water	39 households	26%
Piped water cuts (periodic)	87 households	58%
Piped water cuts (prolonged)	63 households	42%
Broken community taps	20 households	13%
Empty Jojo tank	29 households	19%

The participants were also asked how long the disturbances to the main water supply normally last. With regards to muddy water the responses were as follows: 25 out of 39 households (64%) have experienced muddy tap water for a week, 10 out of 39 households (26%) have experienced muddy tap water for less than a week (1 to 3 days) and 4 out of 39 households (10%) have experienced muddy tap water for two weeks. With regards to periodic piped water cuts the responses were as follows: 13 out of 87 households (15%) usually experience piped water cuts that last for less than a week (1 to 3 days). A total of 46 out of 87 households (53%) experience piped water cuts that last for a week at most (7 days) and 28 out of 87 households (32%) tend to experience piped water cuts that last for two weeks.

Prolonged water cuts have lasted anything from a month to five months and even more for some households. A total of 9 out of 63 households (14%) had experienced a water cut that has lasted for a month, 25 out of 63 households (39%) had experienced a prolonged piped water cut that had continued for two months, 6 out of 63 households (10%) had experienced a piped water cut for three months, 15 out of 63 households (24%) had been subjected to a piped water cut for four months and, 8 out of 63 households (13%) had experienced a piped water cut for five months and more.

Households that have experienced a water supply disturbance caused by broken community taps revealed the following information: for 6 out of 20 households (30%) the disturbance caused by broken community taps has lasted for a week at most, 4 out of 20 households (20%) have felt the effects of a broken community tap for two weeks at most, 5 out of 20

households (25%) have been affected by a broken community tap for a maximum of 3 weeks, for 3 out of 20 households (15%) the disturbance caused by a broken community tap tends to last for four weeks, and for 2 out of 20 households (10%) broken community taps have caused a disturbance that has lasted for more than a month. All 29 households that have experienced a disturbance to their main supply of water due to an empty Jojo tank said that this particular disturbance lasts for less than a week (1 to 4 days at most).

The respondents were asked if represented households are currently receiving water from a source that is considered to be the main water source, even before the village started experiencing water scarcity. This question was designed to get an idea of the level of satisfaction amongst the residents of Borakalalo with current water sources. The water sources that households presently turn to for water, during this period of water scarcity, may not necessarily be sources that household members are pleased with, or perhaps, it may not be a source that household members considered to be the main water source prior to the current water crises in the village. The responses to the above mentioned question were as follows: 87 out of 150 respondents (58%) said that most of the time their represented households receive water from a water source that was considered (before current water shortages) and still is (during current water shortages) considered as the main source of water for represented households. The remaining 63 out of 150 respondents (42%) said that most of the time their represented households are not receiving water from what was considered and still is considered to be the main source of water. All 150 respondents of the represented households said that they consider tap water, directly from the tap, to be the main water source. Sources such as Jojo tanks are not well received by the community. Also, some residents now have to go through extra labour in order to access tap water, whereas before, residents of Borakalalo village could access tap water directly from in-dwelling taps or from the nearest community taps. The quality of water in Jojo tanks and, the labour involved in gaining access to water are major contributing factors to the displeasure that some households have expressed towards their current water sources.

Table 4.7: The time duration of disturbances to the main water supply of represented households in Borakalalo village

Type of disturbance	Time	Number of households	Percentage of households
Muddy water:	Less than a week	10 households	26%
	1 week	25 households	64%
	2 weeks	4 households	10%
Periodic piped water cuts:	Less than a week	13 households	15%
	1 week	46 households	53%
	2 weeks	28 households	32%
Prolonged piped water cuts:	1 month	9 households	14%
	2 months	25 households	39%
	3 months	6 households	10%
	4 months	15 households	24%
	5 months and more	8 households	13%
Broken community tap:	1 week	6 households	30%
	2 weeks	4 households	20%
	3 weeks	5 households	25%
	4 weeks	3 households	15%
	More than a month	2 households	10%
Empty Jojo tank:	Less than a week	29 households	100%

4.7. Perceptions about water from Jojo tanks

Most residents of Borakalalo village who rely on Jojo tanks, either as the current primary water source, or those who view tanks as the secondary water source, are displeased with having to turn to Jojo tanks for water. The residents have expressed very negative impressions about water from the Jojo tank. Most residents are suspicious of the quality of water from Jojo tanks, and blame this water for some of the health problems that residents of the village have experienced. Residents of Borakalalo village have identified health problems such diarrhoea and indigestion as the side effects of physically consuming water from Jojo tanks.

Some 20 out of 150 households (13%) identified the Jojo tank as the current main source of water for their household, meaning that these households currently make use of Jojo tanks more than any other water source. In addition, another 15 out of 150 households (10%) have identified Jojo tanks as a source that represented households occasionally turn to for water. In total, 35 households (23%) in the village make use of water from Jojo tanks, either frequently, exclusively or occasionally. Out of the 35 households that make use of the Jojo tank, a total of 17 households (49%) said that a clear distinction between water that is orally consumed (for drinking or cooking) and water that used for non-consumptive purposes (cleaning, bathing or farming) is made when utilising water from Jojo tanks. These households are highly suspicious of water from the Jojo tanks, thus, Jojo tank water is often not used for physical consumption. Households that do not use Jojo tank water for oral consumptive purposes make other means of gaining access to piped water directly from a tap. The remaining 18 out of 35 households (51%) use water from the Jojo tank for all consumptive purposes, however these households still express a certain level of ambivalence towards water from Jojo tanks.

There were also some households that have made use of the Jojo tank on a few occasions but, however, do not view the Jojo tank as a solid source of water. These households are highly dissatisfied with water from the Jojo tank, and as a result, have separated from this source. Water from the Jojo tank is avoided by such households, even to the extent that household members prefer to walk longer distances to access piped water directly from a tap. A total of 21 out of 150 households (14%) fall under this category.

These are some of the sentiments expressed by the participants:

"I think these Jojo tanks are dirty inside, nobody ever comes to clean them, even my water barrel at home must be cleaned inside once in a while, but these Jojo tanks never get cleaned. I don't trust that water, so I don't drink it or cook with it. I only use it to bath and to clean." (Respondent 72)

"Nobody seems to know where this water from the Jojo tank is from. These people just give us water and expect us to use it without telling us where they get it from. What, they think we don't deserve to know?" (Resident 170)

The residents of Borakalalo are sceptical about the maintenance of Jojo tanks and the source of water in the Jojo tanks. The unrest expressed by the residents of Borakalalo village may serve as evidence to suggest that perhaps the local authorities approach to addressing water scarcity has been, to a large extent, unsuccessful. Even though the local authority has put in effort into securing a water supply for households in Borakalalo, the villagers see their efforts as autocratic because residents were not consulted (Dirix *et al*., 2013). Figure 4.2 is a model of a 'Bottom-up' approach to resolving community environmental problems, whereby the community affected is involved in the problem solving process. However, opinions expressed by respondents suggest that a 'Top-bottom' approach to addressing water scarcity, whereby solutions and mitigation strategies come directly from the local authority and the community is not involved in the problem solving and decision making process, was followed. Residents express hostility about what they view as being 'kept in the dark' about current water problems in Borakalalo village:

"We feel the effects of this water shortages but we don't understand why it's happening and how long it's going to last. We are kept in the dark and wish someone would just come and explain to us what's going on. I have personally gone to the councillor's house to ask him what's going on and, it was sad to see that he was as clueless as I am. The people we choose to represent us are just like us, they can't represent anybody really." (Respondent 100)



Figure 4.2: Bottom-up design for implementing a water scarcity mitigation strategy (Extracted from Dirix *et al*., 2013).

All 150 respondents said that they were not informed why piped water cuts occur from the beginning and are still not informed about details regarding water shortages to date. When asked if they know why piped water cuts occur the responses were as follows: 93 out of 150 respondents (62%) said they don't know why piped water cuts occur, a total of 22 out of 150 participants (15%) said they are not sure why piped water cuts occur, while 8 participants (5%) said that they are aware that water shortages is a plight facing many villages in the province, and thus like most villages in the province, Borakalalo village is faced with water shortages. A total of 6 respondents (4%) said water shortages are caused by stolen electricity generators and 5 respondents (3%) said that water shortages, and poor service delivery in general, has been a salient part of the community since the collapse of Bophuthatswana. A total of 11 respondents (7%) said that water shortages are caused by the growing size and population of the village, and 6 respondents (4%) said that due to poor rainfall patterns, the dam is unable to support the water demands of the village, and henceforth there are water shortages in Borakalalo village.

4.8. Socioeconomic factors that influence household capacity to diversify into various livelihood opportunities

This section will explore socioeconomic traits of sampled households in order to give an overall assessment of the capacity of households in Borakalalo village to effectively respond to water scarcity. Socioeconomic factors such as employment, education, gender and the age of a population contribute to the sustainability of households in the village, and hence, also contribute to a household's capacity to modify livelihood strategies in response to external factors. It is the above mentioned socioeconomic factors, and many other factors, that determine access to resources that are crucial for household sustainability. Thus, it is vital that the socioeconomic composition of households in Borakalalo be analysed and discussed, with an understanding of social and cultural dynamics in rural South Africa, and how various dynamics influence livelihood responses to water scarcity in Borakalalo village (Bebbington, 1999; Chambers & Conway, 1991).

The first socioeconomic aspect that will be explored is employment. In South Africa employment can be divided into various categories, namely: formal employment, informal employment, formal entrepreneurs, informal entrepreneurs and seasonal/temporary

employment. This discussion will include all different forms of employment (Bhorat & Oosthuizen, 2005; Edgren, 2005).

The majority of households in this study have high levels of unemployment. In addition, the informal sector is the biggest provider of employment opportunities in Borakalalo village, with a total of 21% of respondents (31 out of 150 households) generating a financial income solely through employment in the informal sector. Meanwhile, a total of 17% of respondents (26 out of 150 households) generate a financial income through employment in the formal sector. Some individuals draw from both the formal and informal sector. A total of 10 out of 150 respondents (7%) generate a financial income from both the formal and informal sector. Overall 67 out of 150 respondents (45%) have some form of employment, while 55% of respondents do not have any form of employment. In addition, 50% of households (75 out of 150 households) in this study do not have employed household members, either in the formal or informal sector. It is important to note, however, that it does not imply that all households that do not have employed members do not have any form of income entering into the household.

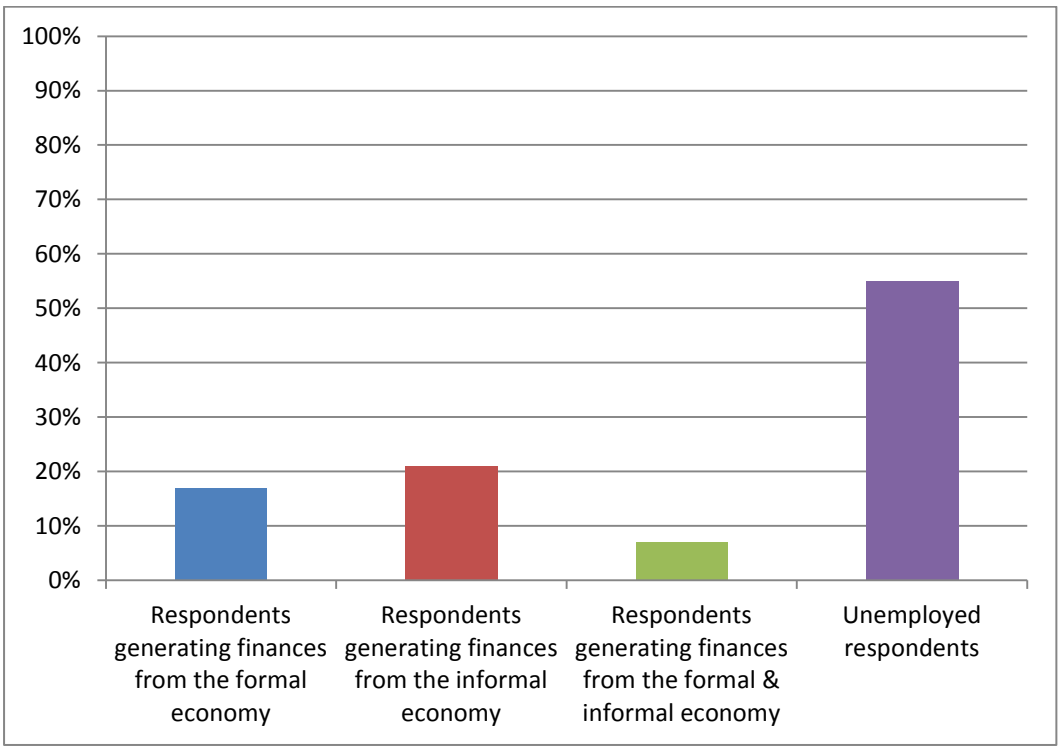

Figure 4.3: Employment levels of respondents

The legal working age in South Africa is 15 years. The South African legislation does not provide a standard retirement age for all citizens, and as a result, the retirement age is a contractual agreement between employer and employee. However, research seems to suggest that the average age that most South Africans choose to retire is 60 to 65 years of age (Edmonds, 2004; Mahery & Proudlock, 2011). In this study, all individuals who are classified as 'within the working age' are between the ages 15 to 65, and those who are classified as 'over the working age' are over the age of 65.

A total of 79% of households (118 over 150 households) in this study have at least one member who is within the working age. While a total of 32 out of 150 households (21%) are made up only of members that have very limited potential of being economically active due to the fact that household members are either under the legal working age, or over the average working age.

Table 4.8: The age composition of households in Borakalalo village

	Percentage of households
Within the working age	79%
Over or under the working age	21%

There are various income sources, both formal and informal, that residents of Borakalalo depend on, and thus, the following section will identify the different ways in which the residents of Borakalalo village generate a financial income. Main household financial income source does not necessarily mean that it's the only financial income source that households depend on, mainly due to the fact that households may gain a financial income from more than one monetary income source. However, the household representatives were asked to identify the household's main financial income source

Table 4.9: The main income source for households in Borakalalo village

Main source of Income	Number of households	Percentage of households
Remittance	19 households	13%
Social grants	44 households	29%
Formal business	4 households	3%
Informal business	8 households	5%
Private or state pension fund	3 households	2%
Formal employment	17 households	11%
Informal employment	24 households	16%
No stable means of generating an income	31 households	21%

The second socioeconomic factor to be looked into is education and skills training in the village. Education and skills training are forms of social capital or intangible assets that open up individuals to various opportunities, with the most valued opportunity probably being a job or the ability to create meaningful working days. A 'decent education' or skill opens one up to opportunities in the economy. When assessing rural livelihood sustainability, it is important to assess the skills and educational level of the household members. Considering the educational and skills level of members will reveal the extent to which households in the village are exposed to opportunities. It could be opportunities in the formal or informal economy, but either way, having a 'decent education' and some form of skill (either formally or informally attained skill) will provide rural dwellers with an opening into the various economies of South Africa (Bebbington, 1999; Modisaotsile, 2012).

Majority of households in this research project do not have members with a matric qualification (Senior Certificate). A total of 101 out of 150 households (67%) do not have members with a matric. On the other hand, only 42 out of 150 households (28%) have at least one member with a matric as the highest educational qualification obtained. A total of 7 out of 150 households (5%) have one member per household with a tertiary education, three of whom have a degree, and four are in possession of a higher diploma.

Skills are also important in generating a livelihood. However, when it comes to skills training there are normally two segments of skilled individuals. There are individuals who have undergone formal skills training under a formal institution, and there are also those individuals who have gained their skills through informal, maybe traditional, institutions (Liimatainen, 2002; Chambers & Cornway, 1991). A total of 32 out of 150 households (21%) have at least one member that has received formal skills training. Households with at least one informally skilled individual total to 22 out of 150 households (15%).

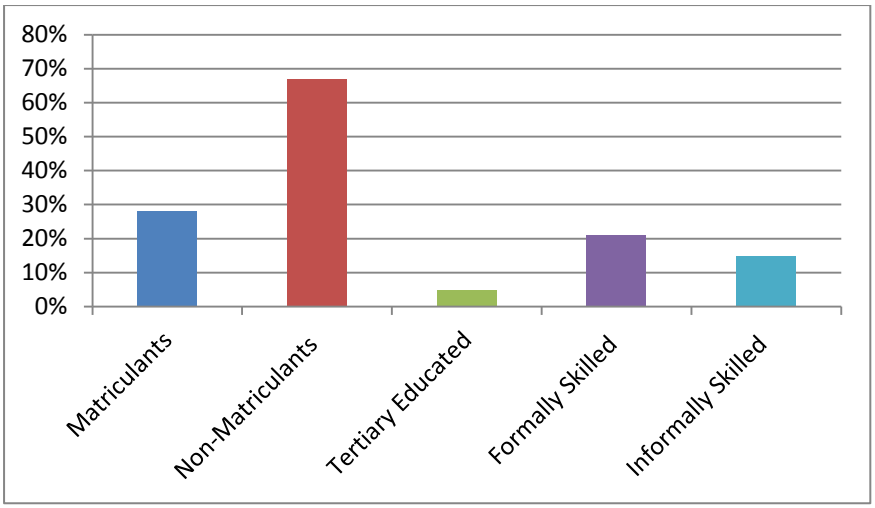

Figure 4.4: Education and skills composition of households in Borakalalo village.

The gender composition of a household also plays a role in determining access to resources and economic opportunities, and this is because gender is a crucial factor in determining access to resources. In South Africa, men are exposed to more job opportunities than their female counterparts, more so in rural South Africa where traditional patriarchal roles are still dominant (Rust & Hanise, 2009). Also, it is normally men who have all the decision making power in the use of resources, as well as access to resources such as land, livestock, agricultural input, water and so forth (Frank, 1998). Therefore, in this study it was crucial that the gender composition of households be considered when assessing the households' access to resources and opportunities.

A total of 45 out of 150 households (30%) have only 1 male member, 60 households (40%) had two male members, 27 households (18%) had 3 male members, 5 households (3%) had 4 male members, while 13 (9%) households on the other hand, had no male members. In comparison to female members, 20 of the participating households (13%) had one female

member, 69 households (46%) had 2 female members, 42 households (28%) had 3 female members, 11 households (7%) had 4 female members, 4 households (3%) had 5 female members, and 4 households (3%) had no female members. There is a total of 348 female members and a total of 246 male members who are represented in this study. All adding to a total of 594 people represented in this study, 178 of whom are children under the age of 18.

Table 4.10: Representation of male members in households of Borakalalo village

Number of households	Number of male members
13 households	0 male members in these households
45 households	Households only have 1 male member
60 households	Households only have 2 male members
27 households	Households only have 3 male members
5 households	These households only have 4 male members
Total number of male members	Together, all 150 households have a total number of 246 male members.

Table 4.11: Representation of female members in households of Borakalalo village

Number of households	Number of female member
4 households	0 female members in these households
20 households	Households only have 1 female member
69 households	Households only have 2 female member
42 households	Households only have 3 female members
11 households	Households only have 4 female members
4 households	Households only have 5 female members
Total number of female members	Together, all 150 households have a total number of 348 female members.

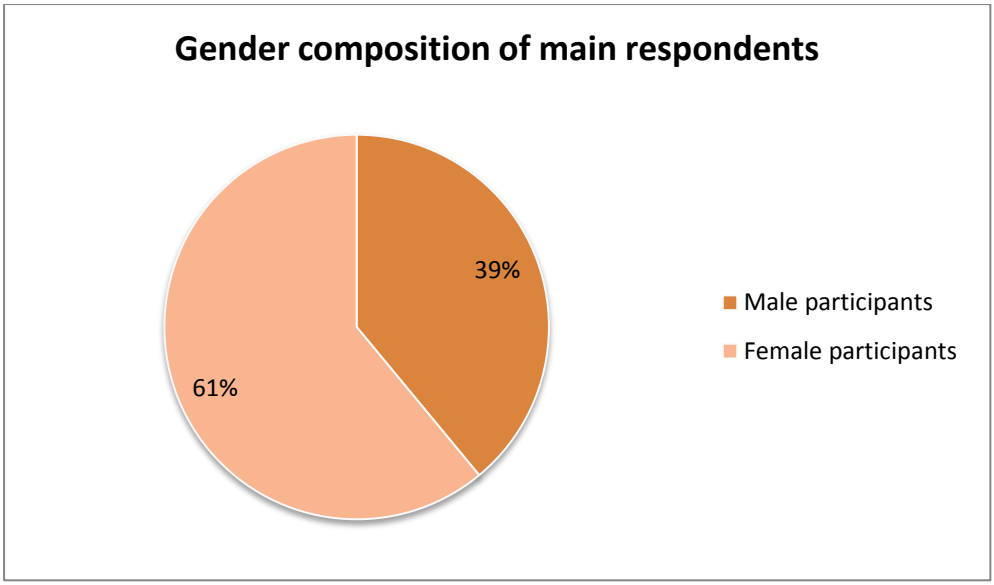

Figure 4.5: Gender composition of respondents

4.9. Conclusion

The results chapter reveal a change in the water usage patterns of households in Borakalalo village in terms of past and present water usage trends. A decline in the number of households that participate in agricultural and livestock production is observed, while all 150 households continue to use water for domestic activities. Households that used water for business purposes under past water usage patterns continue to do so under present water usage patterns, while four more houses have expressed an interest in using water for small scale business purposes.

Even though water scarcity is the biggest contributor to changes in water usage patterns, it is not the only contributor. Some households chose to discontinue engagements with water-related activities for reasons not concerned with present water shortages in the village. Majority of households that abandoned water-related activities because of water scarcity expressed very little interest in engaging with abandoned water-related activities again, if water was readily available. Only 1 out of 46 households that claim to have abandoned livestock farming because of water scarcity has expressed interest in practicing livestock farming again. While only 3 out of 42 households with past engagements with agricultural production, which was put to a stop by water scarcity, have expressed an interest in reengaging with agricultural production once more.

The lack of interest that households express towards reengaging with abandoned water-related activities raises questions about whether water scarcity was the real reason why households chose to abandon some water-related activities. Agricultural crop production seems to be the most valued water-related livelihood activity, with most households expressing an interest in participating in agricultural crop farming if water was readily available. Furthermore, even some households that have abandoned agricultural production have rated it as a 'very important' activity for maintaining livelihood sustainability. However, even though these households rate agricultural production so highly, only 3 households that have past engagements with agricultural production have expressed an interest in engaging with agriculture again.

The spatial and temporal variability of water scarcity in Borakalalo village is evident. Some sections of the village have more reliable access to water than other sections of the village. Also, sections of the village that have uninterrupted water supply most of the time, may suddenly experience water cuts. Some sections of the village, mostly low-lying sections, have access to water while other sections of the village, mostly upper-lying, sections of the village are prone to prolonged water shortages. In some instances, even Jojo tanks in upper-lying sections of the village may run dry, thus leaving residents in upper-lying sections of the village with no option but to seek water from other sections of the village or from neighbouring villages. Furthermore, households in Borakalalo village face various disturbances to the main water supply. The disturbances that have been identified are as follows: prolonged and periodic water cuts, muddy tap water, broken community taps and empty Jojo tanks. All these disturbances are challenges posed to household access to water in Borakalalo village.

The socioeconomic composition of households in Borakalalo village reveals that 21% of respondents rely on the informal economy. While, more than half the households in this study have no employed members (55%) and 21% of households do not have a stable monetary income. Furthermore, 29% of households depend on social grants as the main source of a financial income.

Chapter five: Discussion

5. Introduction

This chapter is a discussion of the results of the household survey that was conducted on 150 households in Borakalalo village. The aim of this research is to provide an understanding of the link between household water usage and livelihood sustainability in rural areas, through studying the water usage patterns of households in Borakalalo village. This research looked into current and past water usage patterns in Borakalalo village, in order to understand how rural household water usage is affected by limited access to water and, how livelihoods are in turn affected by changes in water usage patterns.

The phrase 'current water usage' is used to refer to water usage trends that are presently visible in Borakalalo at the tie of this investigation. While 'past water usage patterns', on the other hand, refers to the water usage trends that dominated household water usage, before Borakalalo village was threatened by water scarcity. A comparison between past and present water usage trends revealed that households in Borakalalo village have changed ways in which water is used in response to the plight of water scarcity. 'Potential water usage', on the other hand, is used to refer to possible water usage trends that would be expressed in Borakalalo village if water scarcity was not a limiting factor. Consequently, uncovering activities that households in the study area aspire to use water for, if water was more readily available, reveals the extent to which water scarcity limits the livelihood options that households in Borakalalo village choose to engage with (Kanyoka *et al*., 2008; Keshavarzi *et al*., 2006; Pollard *et al*., 2002).

5.1. Knowledge gap about household water usage in rural areas of South Africa

There is a lack of knowledge about water usage trends in rural areas, and therefore, there is limited understanding of how water scarcity impacts the livelihoods of rural households. The focus of rural water provision in South Africa has often been on providing basic water needs, under the premise that rural dwellers use water mainly for domestic purposes. Very little attention has been given to productive water activities that rural households in South Africa utilise water for (Butterworth *et al*., 2003; Mokgope & Butterworth, 2001; Moriarty & Butterworth, 2003; Pérez de Mendiguren & Mabelane, 2001; Soussan *et al*., 2003).

As discussed in chapter one, the BHNR (Basic Human Need and Reserve) that was enacted to the 1998 National Water Act focuses on providing water for basic human needs and does not make additional provision for productive livelihood activities. The BHNR is based on standards set by the free basic water policy of 2000 which makes 6000 litres of water per household per month an entitlement (Dlamini, 2007; Perret, 2002). However, the BHNR came under question during the time of prepaid water meter installations in South African townships. The installation of prepaid water meters resulted in free water being limited to 6000 litres per month per household. Township households were suddenly faced with the financial challenge of having to pay for any additional water requirements. Unlike when households were billed on a monthly basis for any additional water past the 6000 litres of free basic water mark, the installation of prepaid water meters meant that households had to make direct payments for any additional water before accessing it. Prior to the installation of water meters in South African townships, water was considered to be free by most people. This was mainly because cash payments were not required in order to access water, and as a result, water was accessed freely by all. Most people did not consider settling the monthly water bill as important for ensuring access to water. However, prepaid water meters made water payments a prerequisite for accessing water. The introduction of prepaid water meters meant that residents of Phiri suddenly had to pay for any additional water upfront before accessing it, and as a consequence, the installation of water meters was met with public protests in Phiri Township, Soweto (South Western Townships). The residents of Phiri Township complained that the free basic water provision of 6000 litres of water per month per household was not enough to meet the domestic water needs, and let alone the productive water needs, of poor households in Soweto. Many of the poverty stricken residents of Phiri Township could not afford to pay for any further water requirements once the free basic water supplied had been exhausted (Earle *et al.*, 2005; McDonald & Ruiters, 2006). Therefore, this case study serves as a clear demonstration of the lack of understanding of household water needs in poor urban South African communities. There are shortcomings in the BHNR's capacity to meet the water needs of the urban poor, however, questions have been asked about the suitability of the BHNR in providing for rural water needs. Some scholars, who counter the idea of the BHNR possibly

being suitable in addressing rural water needs, argue that this suggestion expresses incomprehension about the water use of households in rural areas. It is suggested that 6000 litres of water per household per month will not be enough to meet the productive water needs of rural households. Most rural households in South Africa often engage with water-related livelihood activities such as livestock and agricultural farming, as well as small rural water-related enterprises. Pollard *et al*., (2002) state that there is an assumption made that the water supply standards set by the BHNR will be sufficient to meet actual and potential rural water needs, not just for domestic purposes but also for small scale production. The recommended water consumption per person per day for domestic use is 5 litres, while the water needed for meeting the daily recommended human dietary requirements, of 12600 KJ per person per day, is 3500 litres per person daily. That is 70 times more than the recommended water provision standards (SIWI, 2005; SIWI-IWMI, 2004; Wenhold *et al.*, 2007). These estimates serve as a clear indication of the disparity between the BHNR (and other water provision parameters) and the estimated human water needs for food production alone. Moreover, in addition to the BHNR the South African basic water supply is also defined as 25 litres per person per day (Matshel *et al*., 2013). The extent to which the BHNR and the set basic water supply parameters are insufficient in meeting daily productive and domestic water needs for most households is thus a source of great concern.

5.2. Understanding how external factors influence rural livelihood strategies

Livelihood strategies of households are determined by the availability of assets and capabilities. When resources are under threat, households develop various coping mechanisms such as: substituting threatened livelihood activities with new ones, reducing the level of interaction with the threatened livelihood activities or assets, and at times if possible, taking from other resources in order to compensate for the loss of one resource. Livelihood strategies are often subject to various changes depending on external factors, that is, external shocks and stresses (Bebbington, 1999). The household's capacity to cope with shocks and stresses is referred to as adaptive capacity. Household livelihood sustainability is measured by the household's capacity to withstand external threats posed by challenges such as environmental problems, social or political unrest and economic challenges. Therefore, this section will look at the adaptive capacity of households in Borakalalo village, in withstanding external stress caused by water scarcity.

5.3. The effects of reduced agricultural crop production and possible solutions

The results chapter shows a clear reduction in the diversity of productive activities that households in Borakalalo village choose to engage with ever since water resources came under threat. The total number of households that no longer use water for diverse activities has increased from 39% to 55%, in other words, the number of households that now use water only for domestic purposes has increased by 16%. Even so, not all households that have chosen to discontinue engagements with water-related activities have done so because of water scarcity. A total of 42 out of 53 households (79%) that chose to discontinue engagements with agricultural crop production chose to do so because of water shortages in the village. While 21% of households (11 out of 53 households) chose to discontinue engagements with crop production for other reasons not pertaining to water shortages currently experienced in the study area. Overall, a 13% decline from 35% (53 out of 150 households) to 22% (33 out of 150 households) in the use of water for agricultural purposes is evident.

Changes in water usage patterns are evident and identifiable mainly in productive activities. It can be argued that because some of the households in Borakalalo village no longer engage with productive livelihood activities, household livelihood strategies have been modified in order to withstand current water shortages. However, it cannot be assumed that livelihood modifications have been successful for all households. The different coping mechanisms utilised in every household are determined by the diverse and unique combination of assets and capabilities contained within different households. Assets and capabilities vary from household to household, and equally, households do not have the same coping mechanisms. Furthermore, households also possess different levels of resilience against external stresses and shocks such as water scarcity (Bebbington, 1999; Ellis, 2000).

It is noted by scholars such as Gerbens-Leenes & Nonhebel (2004) that agricultural production is the most water-intensive socioeconomic activity in the world. It is estimated that approximately 70% of the world's freshwater is used for agricultural production. Although the process of de-agrarianisation, a process whereby households move away from agricultural production and begin to depend on social grants, is described as a trend that is evident in most parts of rural South Africa, the role that rural agriculture still plays in

increasing food security in rural areas is well understood by the South African government (Daniels *et al.,* 2013) Regardless of the growing trend of de-agrarianisation, the government continues to show support for small scale agricultural cooperatives in rural South Africa (Du Toit, 2009; Rich, 2011). The South African National Department of Agriculture, Forestry and Fishery (2011) also state that agricultural production plays a pivotal role in ensuring rural development.

The importance of agricultural production in rural areas is further highlighted in Borakalalo village where a total of 20% of households express a heavy reliance on agricultural farming. For these households, agricultural production is a 'very important' and irreplaceable livelihood activity for maintaining livelihood sustainability. In addition to this, 36% of households view agriculture as 'important' for generating a livelihood. However, for such households, surviving without agricultural production puts strain on the financial income or other resources in the household. For 10% of households in this study, agricultural production bears 'seasonal importance' for livelihood production. Moreover, 25% of households that do not currently engage with agricultural production have expressed an interest in engaging with this activity. A total of 30% of represented households expressed that limited access to water has had negative impacts on the household's capacity to secure adequate nutrition, and therefore, it can be argued that household food security is under threat due to water shortages in the village.

Considering the level of importance of agricultural production in generating a livelihood for households in Borakalalo village, it is expected that current water shortages threatening agricultural production would have adverse effects on livelihood sustainability for households in the study area. According to Hubbard (1995) food security cannot be separated from access to water in rural areas, simply because water is a necessary resource for food production. Khosa (2003) laments about the high monetary and time costs of accessing water in rural areas, saying that the high costs of accessing water in rural areas reduces potential time and money that could be invested into other aspects that ensure rural household sustainability (Crow *et al*., 2012). The time cost of accessing water in rural areas is normally higher than in urban areas because not all rural households have in-dwelling taps. Also, considering the high unemployment in rural areas, it could also be argued that the financial cost of accessing water is unbearably high for unemployed and

poor rural dwellers. In addition, the cost of accessing water in Borakalalo village is now even higher as some households have to pay water deliverers. Also, collecting water has now become a time consuming task that involves moving from community tap to community tap and from Jojo tank to Jojo tank in efforts to secure access to water, especially during 'absolutely dry times'. It is thus clear that the time costs of accessing water in Borakalalo village have also gone up. Time that could be invested into securing other livelihood opportunities is now spent in securing access to water. The current situation in Borakalalo village disadvantages households and limits household capacity to diversify into other livelihood generating activities (Crow *et al*., 2012).

Reduced agricultural production results in households spending more money on food in comparison to when most of the agricultural produce was produced through subsistence agricultural farming. The act of drawing from financial resources is one way of modifying livelihood strategies in order to ensure access to food. However, in a village with 50% household unemployment, and a total of 21% of households that do not have a steady monetary income, compensating for agricultural production by taking from financial resources strains the limited financial income entering into these households. Baiphethi & Jacobs (2009) claim that approximately 60% to 90% of the income generated in poor households in Sub-Saharan Africa is spent on food, thus, subsistence agriculture is essential for reducing food insecurity and reducing total expenditure on food in poor rural and urban households.

The main source of financial income for most households in Borakalalo village is social grants, with 29% of households regarding social grants as the main source of income. In addition, a significant percentage (16%) of households relies on informal employment and, 5% of households are dependent on informal business enterprises. In most cases informal employment is characterised by poor job security, no formal employment contracts, no insurance cover for job related injuries or illnesses, no unemployment funds, no social benefits and low wages. Therefore, although the informal sector absorbs individuals who are excluded from the formal economy, the lack of job security that comes with informal employment or informal businesses makes livelihoods that are highly dependent on financial income from the informal sector vulnerable (Kingdom & Knight, 2003). Households in Borakalalo village that rely on social grants or generate money through the informal

sector are very sensitive to any kind of increased pressure on the household financial resources. Subsequently, such households will feel the effects of decreased agricultural productivity as a result of water scarcity. Households with low financial income will feel the pressure of having to compensate for decreased food production by increasing financial spending on food:

"*Generically, agricultural activities have become important alternative means of supplementing family income in rural areas in South Africa. Over one third of rural households continue to engage in agricultural production, making it the third most important livelihood tactic used in rural areas after remittances and wages from low-skilled jobs."* (Wenhold *et al*., 2007: 328)

High unemployment in Borakalalo village makes it difficult for households to diversify and compensate for reduced agricultural production through finances. Employment ensures improved social conditions by increasing the financial capacity of households to invest in overall human welfare. Meaningful employment secures household income that can be invested into education, health or physical resources such as food, water and electricity, all of which play a role in sustaining livelihoods. Therefore, employment plays a pivotal role in sustaining rural livelihoods, and when unemployment is high, a household's capacity to respond to external stresses such as water scarcity is low (Cohen & Moodley, 2012). Consequently, taking from financial resources (obtained mainly through social grants) in order to secure access to food puts unnecessary strain on household finances, hence resulting in reduced social spending. The costs of securing food can be reduced through the practice of subsistence agriculture, especially in poor rural communities where financial resources are limited due to high unemployment.

The low levels of education and skills evident in Borakalalo village further decrease employment prospects for villagers. A total of 67% of the sampled household representatives do not have a matric qualification. Formally skilled participants total 21%, while informally skilled individuals total 15%. Education and skills play a crucial role in determining access to the economy and other livelihood resources. Households that are classified by low education and skills level are often excluded from the labour force, and therefore, very limited finances enter into such households.

What is considered to be a decent education is a subject that is currently dominating various debates in South Africa. The question is often about whether a decent education should be measured according to the quality or quantity of basic education. Modisaotsile (2012) suggests that with the number of enrolments made into the basic education system being higher than that of matrics who successfully exit the basic education system, it is clear that the quality of South African basic education is at a crisis. However, quantity is also a concern due to the fact that most of the matriculants who successfully exit the basic education phase often do not meet the minimum requirements for a university entrance. It is problematic when learners exit the basic education system without having grasped the essential skills and knowledge required for them to advance to the next phase of education or to become economically productive citizens, able to find or create job opportunities for themselves and for others. Therefore, in this case, both quality and quantity become a concern. The quality of basic education in South Africa should be at a level which ensures that majority of learners successfully exit the system competent enough to either join the labour force, start-up small business enterprises or to advance to the next phase of education.

This poses a question of whether or not individuals who have successfully exited the basic education system, but do not possess the literacy and numeracy skills that would open one up to opportunities in the economy, will be able to contribute to generating a livelihood. Most individuals who exit the basic education phase lacking the required level of literacy and numeracy skills are often excluded from the economy. Therefore, even employment prospects for most matriculants are often bleak (Modisaotsile, 2012). It is estimated that an annual total of 325 000 to 462 000 matriculants are excluded from the economy and fail in gaining meaningful employment (Agbenyegah, 2013). This statistic suggests that there is a high possibility that 28% of households in Borakalalo village, having a matric as the highest educational qualification obtained in the household, may also be excluded from the economy. Only 5% of households in Borakalalo village have either a National diploma or degree as the highest educational qualification. With the quality of matriculants produced through the basic education system being highly criticised, it may be just as difficult for matriculants to gain access into the economy as it is for non-matriculants (more especially the formal economy). All this emphasises the limited social capital of households in

Borakalalo village, resulting in households that are heavily reliant in natural resources, and ultimately, households that are very vulnerable to water scarcity.

A study conducted in Lehurutshe district, specifically in Mantsie village, shows that the respondents in the study have observed dry and regular droughts in the region. Droughts experienced in Mantsie Village have a negative impact on the livelihoods of households in the region. Respondents in this particular study expressed that food security, health, energy levels and overall welfare of households is negatively affected by observed decline in rainfall. Also observed by the respondents is an increase in inter-annual climate variation. In efforts to respond to climate change and, ultimately the effects of climate change on water availability, villagers in Mantsie have reduced their interaction with agricultural crop production and have gone on to concentrate mainly on livestock production. Animal production is a risk buffer for crop failure, as livestock farming is generally viewed as a lower risk livelihood activity than crop production (Francis, 2002; Herrero *et al*., 2010; Thomas *et al.,* 2006).

Empirical findings from a nationwide study shows that moving away from rain fed agriculture to irrigated agriculture has been an effective coping mechanism for climate change in some regions, specifically towards the following climatic changes: reduced rainfall and temperature in winter and reduced rainfall and increased temperature in summer. In summer the benefits of increased temperature outweigh the negative effects of decreased rainfall in regions such as Limpopo, the North West and the Free State. Farmers in the above mentioned regions generally move from rain fed agriculture to irrigated agriculture in order to compensate for the decrease in rainfall. Increased temperatures seem to have favourable effects on crop production in those regions, mainly because farmers in those provinces concentrate on heat tolerant crops. In other words, these results suggest that commercial agricultural production in Limpopo, the North West and the Free State is more sensitive to a decrease in temperature than it is to a decrease in rainfall, mainly because, a decrease in rainfall can be effectively responded to by relying on production through irrigation and, not rain fed production. Changes associated with climate change, specifically a 2 degrees Celsius increase in temperature and a 5% reduction in rainfall, have yielded some favourable results for commercial agricultural production in the North West Province. Unlike emerging or subsistence crop farmers, large commercial farmers have sophisticated irrigation schemes

to compensate for decreased rainfall (Gbetibouo & Hassan, 2005; Perret, 2002; Perret *et al.,* 2006).

In the water scarce region of Lehurutshe district, where there is evidence of both physical and economic water scarcity, the coping mechanism of moving away from rain fed agriculture to irrigated agriculture is not possible for emerging farmers who have limited access to irrigation water. Poor water delivery and infrastructure are some of the economic factors that continue to give rise to limited access to water for households in Borakalalo village (Francis, 2002; Herrero *et al*., 2010; Molden *et al.,* 2001; Thomas *et al.,* 2006). With such challenges in basic water delivery and infrastructure, it is expected that irrigation schemes that allow rural farmers to dodge the challenges posed to agricultural production, by decreased rainfall, do not exist in most poor parts of Lehurutshe. Households in Borakalalo village do not have the means to compensate for a decrease in rainfall such as in the case of commercial farmers in the North West Province. In addition, poor access to water in Borakalalo village, due to physical and economic water scarcity, has caused households to prioritise water for domestic use, and in many instances, additional water is not available for irrigated agricultural production (Gbetibouo & Hassan, 2005).

Whereas there is poor water infrastructure in former homelands, there is often sophisticated irrigation technology in white owned commercial farms. Disparities in access to natural resources represent a legacy of inequality left by the Apartheid regime. Although 1.3 million ha is under irrigation in South Africa, only 0.1 million ha under irrigation belongs to smallholder irrigators (Backeberg, 2006a). The term smallholder irrigator is used to refer to home based gardeners, community gardeners, independent irrigation farmers and farmers on irrigation schemes (Crosby *et al*., 2000; De Lange, 1994; Du Plessis *et al*., 2002). A lot of emphasis has been placed on commercial agriculture and, water has been prioritised for commercial farming over small scale agricultural cooperatives in rural areas. Although commercial farming is more important for food security on a national and global scale and, for advancing national economic development, commercial farming does very little in ensuring local development and food security for the rural poor. South Africa is a food secure country on a national level, in spite of this, on a local level approximately 35% of the population is vulnerable to household food insecurity (De klerk *et al*, 2004). In order to increase household food security and to encourage rural development through agriculture,

resource redress with regards to the distribution of water in rural South Africa is a necessity. Encouraging smallholder irrigation schemes could improve access to water for subsistence farming; especially through small scale agricultural cooperatives (van Averbeke & Mohamed, 2007).

With the shrinking human capital in rural areas, and the decreasing capacity for most households to participate in subsistence agriculture, communal farming through agricultural cooperatives could benefit households that do not have the labour power to participate in agricultural production. Feeding schemes could result from communal farming projects, and such schemes could play a role in increasing food security in child headed or elderly households. According to Ainslie (2005) a decrease in human capital in rural Eastern Cape is one of the causes of de-agrarianisation in the province. A lack of work opportunities in rural areas has resulted in a young and potentially economically active population leaving rural areas for towns and cities in pursuit of economic opportunities. The consequences thereof is that an elderly and mostly sick population is often left behind in rural areas, and such a population does not have the labour capacity to engage with agricultural production. However, if the small remaining rural population with the potential of being economically active could be mobilized for communal agricultural projects, this would encourage economic and social development in rural communities. A total of 21% of surveyed households in Borakalalo village are made up strictly of members who are over the working age of 65 years or under the working age of 15 years. People over the age of 65 years and those under the age of 15 years have very little capacity to generate a livelihood income, because in most cases these are people who are not economically active. As a result, households made up of pensioners or young children may not have the physical capacity to engage with agricultural production. The sentiments expressed by some respondents in Borakalalo village further highlight the effects that a shrinking human capital in rural areas is having on agricultural production:

"We don't have anybody to work the field because youngsters finish school and go and seek employment outside the village. It's not like we don't need the agricultural produce, we still need it because these young people forget all about us and we suffer while they are driving fancy cars in the cities." (Respondent 62)

"I'm not a young girl anymore and I don't have the strength to work the field. These young people say that they will not be caught dead working the field. They also say that farming is old fashioned, and that it's too hot for them to be slaving away in the heat. They forget that it's my slaving away in the heat that has put food on the table for them. They are full of empty pride." (Respondent 15)

Furthermore, centralising rural agricultural production into community agricultural projects, rather than having individual households concentrate on private subsistence agricultural production, would make it easier to deliver irrigation water. The local government authority may not have the capacity to ensure that irrigation water reaches every single rural household, but however, if agricultural production was to be centralised into community projects, less of a challenge could be experienced in delivering irrigation water for agricultural production. A study on the role of community gardens in increasing food security in Hammanskraal (Pretoria) revealed that community gardens are effective in reducing household food insecurity and reducing total cost of food, thus increasing household disposable income. The study also showed that through community gardens residents of Hammanskraal are able to diversify their dietary intake and increase household incomes through the sale of surplus produce. Nkosi *et al*., (2014:2) defines community gardening as *"gardening arrangements by a group of community members who come together to plant and produce their own fruits and vegetables for either consumption or sale, and sometimes a combination of both. These gardens come in various shapes and sizes. Some may be based on shared tasks, whilst others take the form of individuals sharing one area but each cultivating a different plot."* Local government authorities should also see food gardens as a way of engaging individuals in meaningful economic activity, strengthening community bonds and creating entrepreneurial opportunities for the youth. Thus community gardens may play an influential role in reducing crime. Furthermore, community gardens would be effective in encouraging smallholder irrigation schemes and bringing an income into the village. However, in order for community gardens to flourish, the following community agricultural support is needed: financial support for equipment and implementation of smallholder irrigation schemes is required, educational support and training for community gardeners is required (especially on agricultural practices such as organic mulching in order to counter the effects of water scarcity) easy access to agricultural

land, water and, seeds and the mobilisation of communities to take agriculture as a career and not just as a seasonal activity is pivotal (Aliber & Hart, 2009; Faber *et al*., 2010; Nkosi *et al*., 2014; Ortmann & King, 2010).

The state's failure to provide sufficient support for community based agricultural production is a direct result of failure in redress matters. Failure in land reform is evident in the Eastern Cape with most of the land that was redistributed to previously disadvantaged communities falling back into the hands of commercial farmers and entrepreneurs instead of the poor, landless and economically excluded. Previously disadvantaged communities preferred a cash settlement over land. Communities chose a short term and band aid solution to poverty rather than a long-term solution to the cause of poverty, which is, inequality in resource distribution in South Africa (Bank & Minkley, 2005). In addition, failure in the redistribution of water is evident in former homelands. Poor rural water infrastructure, lack of irrigation schemes for agricultural production and a general lack of support for the possible and actual use of water for small scale rural production, serve as evidence of inequalities that still exist in the distribution of water in South Africa. Former homelands continue to trail behind in terms of access to productive resources such as land and water (Francis, 1999).

5.4. The effects of water scarcity on livestock production

A 15% decline from 45% (67 out of 150 households) to 39% (59 out of 150) in the use of water for subsistence livestock production is evident in Borakalalo village. In addition, a total of 69% of these households chose to stop livestock production due to water scarcity, while 31% chose to discontinue engagements with livestock production for other reasons not pertaining to water shortages in the village. This section will therefore unpack the effects of a decline in subsistence livestock production on livelihood sustainability in Borakalalo village.

The meaningful contribution that subsistence livestock production makes to poor rural livelihoods in the developing world is undeniable. Livestock production has some environmental, social and economic benefits for the rural landscape. However, as environmentally beneficial as livestock production can be, when mismanaged, livestock can also have detrimental effects on the environment. Livestock production is environmentally

valuable in maintaining soil fertility for crop production and converting inedible vegetation, by-products and waste products into food for human consumption. Nonetheless, livestock production is often criticised by the international community for increasing 'Greenhouse Gas Emissions' and contributing to land and water resource degradation (Swanepoel *et al*., 2010).

The value of services and products provided through livestock production are vast and include economic and social benefits. Livestock provides opportunities for the production and marketing of animal based foods and products. Animal based foods such as eggs, butter, milk and meat provide nutrition in rural areas. It is also common practise in rural areas for animal based foods to be sold in order to gain a financial income for other household needs. Animal based products such as leather, wool and goat skin products play a meaningful role in securing household finances. Additionally, the use of livestock for transportation, the use of animal labour in agricultural production and, the use of livestock for the provision of manure for agricultural production are all common practises in many rural areas of the developing world (Swanepoel *et al*., 2010). Productive animals may also play a pivotal role in maintaining cultural heritage, mainly because livestock is often used in some South African cultural ceremonies. In rural areas of South Africa, livestock is useful for boosting the social status of livestock owners. Livestock is viewed as a symbol of wealth amongst South African rural dwellers and, productive animals (mainly cattle) play a role in securing marriage through Lobola/Magadi. The words Lobola or Magadi are used to refer to a bride price that is paid to the bride's family by the groom's family in traditional South African cultural practices. Traditionally, the bride price was paid in the form of cattle but, over the years tradition has evolved to suit the economic advancement of African people. As a consequence, a bride price paid in the form of money is now acceptable. In South African urban areas, black South Africans/Africans are often faced with the challenge of maintaining traditional cultural practises while also advancing into new popular urban cultures with different value systems. In urban parts of the country a bride price in the form of money instead of cattle is widely acceptable. Despite this, in most rural parts of South Africa people continue to remain steadfast in practising cultural traditions, thus in most rural areas of the country Lobola or Magadi is still paid in the form of cattle (Nkosi, 2011; Sithole, 2005). Livestock is also a form of financial investment that can later be used to secure other forms

of capital such as a tertiary education. Although crop production in rural areas is essential, it is more high risk than livestock production mainly because crop production is prone to failure. Hence livestock production plays the role of a risk buffer by reducing risks associated with crop failure.

In Borakalalo village, 28% of households in this study view livestock production as an 'important' activity for livelihood sustainability. For 12% of households in this study, livestock production is 'seasonally important', mostly when it's needed for cultural reasons. For 8% of households currently engaging with livestock production, livestock is a 'very important' and irreplaceable livelihood activity. In total, livestock production has some form of significance for 48% of households in this study. What is evident in this study is that: there are more households that value agricultural crop production, at different degrees, than there are households that value livestock production. More than half of the households in this study (66%) value agricultural crop production at different degrees, either as 'important', 'seasonally important' or 'very important', in contributing to livelihood sustainability. While on the other hand, only 48% of households value livestock farming at different degrees, either as 'important', 'seasonally important' or 'very important', in contributing to livelihood sustainability.

The results in the study that was conducted on Mantsie village in Lehurutshe district suggest that villagers in Mantsie chose to participate in livestock farming over agricultural crop farming as a response to climate change. Livestock farming is viewed as lower risk than agricultural crop farming due to the risks associated with crop production and, the high possibility of crop failure. Similarly, in the neighbouring village of Borakalalo there are more households that are currently participating in livestock production than there are households that are participating in agricultural production (Francis, 2002; Herrero *et al*., 2010; Thomas *et al.,* 2006). An overall total of 39% of households are currently practising livestock production and, only 22% of households are currently practising crop production. Under past water usage patterns, there were still more households that practised livestock production than there were households that practised agricultural production. Despite this, according to how household representatives who rated the value of different water-related activities in maintaining livelihood sustainability, crop farming is valued more than livestock production. Even though there are more households practicing livestock farming than there

are households practising agricultural production, crop farming still seems to be valued more than livestock farming, according to the ratings of the value of different water-related activities in sustaining rural households in Borakalalo village. The risks associated with crop farming are higher than risks associated with livestock farming, and this could be the reason why most households choose not to practice crop farming even though the activity is valued more than livestock production. These results contradict the argument made by Maura *et al*., (2003) who state that livestock production is still the most preferred form of agricultural production in rural Africa. Be that as it may, the gender of the respondents may have created some subjectivity when respondents were asked to rate the value of different water-related activities in contributing to livelihood sustainability. There were more female respondents than male respondents in this study. Overall, 61% of respondents in this study were women and 39% were men. Agricultural crop production is an activity that is practised mainly by women and children in rural areas, and livestock production, on the other hand, is practised mainly by men (Campbell *et al*., 2003; Jiggins *et al*., 1997). Therefore, these results seem to suggest that for the household representatives in this study, who were mostly female, crop production is regarded as more valuable than livestock production in generating a livelihood. Moreover, this seems to be a subjective reality because empirical evidence in this study shows that there are more households that participate in livestock farming than households that participate in agricultural farming. Literature also seems to argue that livestock production is lower risk than crop production, and as a result, rural households tend to concentrate more on livestock production than on crop production. The quote below further highlights the cultural and social significance of livestock herding:

"*These cows come from my father, and they come from cows that were given to my father by my grandfather. My grandfather's father also got some of his cows from his father. Even though my sons live the city life, even they know the importance of this family heritage. My eldest son comes home once every month to check on the cows, it's in his blood, and even though he is in the city, the cows are in him. No matter what, water or no water, we must keep the family tradition. Our cows are our wealth, and without the cows we are poor, even though we may have paper money we would still be poor."* (Respondent, 143)

Bebbington (1999) argues that the notion of livelihood sustainability should not be limited to a materialistic approach of measuring livelihood sustainability. It would be an error in

thinking to assume that wealth, or poverty is understood in the same manner in all societies. For some, the cultural value or the cultural meaning attached to resources is more meaningful or rewarding than the monetary value of the resources themselves. Therefore, people do not just interact with resources merely for the purpose of generating an income. As demonstrated in the quotation above, there are cultural services and traditional meanings attached to certain activities and certain resources and, those meanings may not necessarily correlate with a conventional or dominant economic understanding of wealth or poverty.

Livestock farming increases social networks in rural communities through cooperative cattle herding, as well as the dealing and trading of productive animals. Livestock also provides social status and political power for livestock owners in their communities (Swanepoel *et al*., 2010). There is an emerging challenge of livestock theft in Borakalalo village. The community sees it as beneficial to come together in efforts to fight increasing livestock theft. Neighbourly bonds are strengthened through looking out for community livestock. People have become more aware of other people's livestock and are quick to notify their neighbours of any suspicious activities, or of any outsiders who mostly come into the village to commit crimes against residents of Borakalalo village. Unlike crop farming, cattle herding is a community activity in Borakalalo village. Livestock herders often meet and socially interact during grazing and watering of livestock, and therefore strengthening social bonds that are essential for livelihood sustainability. Crop farming on the other hand, may not have the same effects in creating social networks due to the fact that crop production is mostly practised on residential property in the form of home based crop gardening, and there are very few opportunities created for joint crop production. Residential gardening is preferred because the garden is in close proximity to the dwelling, and thus accessing the garden is easy. Also, residential gardens are normally fenced in, which protects the crops from damage by livestock (Andrew & Fox, 2003; Mkile, 2001).

Livestock is essential for diversifying and increasing nutritional choice in rural areas. A recommended diet consists of 80% plant based foods and 20% animal based foods (SIWI-IWMI, 2004). Animal based foods such as milk, specifically cow milk, is considered to have significant nutritional value for child development (Tangka *et al*., 2000). Animal produce is a vital potential source of nutrition in rural areas, specifically a source of protein. Moreover,

because rural people tend to produce high volumes of the same crop, there is very little crop diversification evident in rural crop production, livestock production tends to provide much needed nutritional diversification (Fanzo *et al.,* 2013; Swanepoel *et al*., 2010). Mono-crop production results in inadequate nutritional intake and, in order to get optimal benefits from crops, much more crop diversification than what is currently practised in rural South Africa is necessary (McDermott *et al.,* 2010).

Animal slaughter is not favoured in rural South Africa unless slaughter is for traditional ceremonies. However, when animal slaughter does take place the meat is shared within the community. Sharing is crucial for spreading the nutrients across the community so that as many people as possible benefit. However, because so much of the slaughtered animal is shared across the community, the nutritional benefits are minimal. Subsequently, people do not benefit as much as they would if the slaughtered animal was not dispersed across the community (Wenhold *et al*., 2007). Slaughtering livestock for traditional purposes and sharing the meat in the community is essential for social livelihood sustainability and, it is a useful practise for enhancing social bonds in rural communities and increasing the nutritional intake of a number of households.

A significant percentage of the respondents, 31% of respondents, note that due to the high death rate in Borakalalo village and the surrounding villages, there is a funeral almost every week. Adding to the number of funerals taking place in the village is the fact that even people who are not permanent residents in Borakalalo village, but were nonetheless born in the village and consider Borakalalo to be a second home[16]often get buried at their place of birth, in their rural home also considered to be the ancestral land (James, 2009; Saccaggi, 2012). The poorest households in Borakalalo village benefit the most from frequent funerals in the community, mainly because, it is an opportunity for such households to access nutrition that poor households would otherwise not be able to access on their own. At local funerals people in the community have the opportunity to access a wide range of foods, from animal to crop based foods. In addition, funeral attendees are sometimes given the freedom to take food leftovers home with them and, for some households, food leftovers

[16] A second home is a place to return to from weekend to weekend, holiday to holiday and sea son to season. The term second home is often used to refer to as a vacation or recreational home (Hoogendoorn, 2010:44-45).

from a funeral could be the only nutrition accessed for an entire week. The quotation below by one of the respondents captures the role that livestock slaughter plays in ensuring food security for poor households in Borakalalo village:

"People are dying now in the village. People are walking around with all kinds of sicknesses so almost every week we have a funeral. It's a bad thing but you know, if it was not for funerals some people would not have the opportunity to eat meat. Some households that can't afford to buy meat don't even need to anymore, all they have to do is go to a funeral and come back with a week supply of meat. Not meat only, but all kinds of foods that they can't afford. There are people who literally live off funerals here at home, it's not like in Gauteng, there when you are poor you have no one who will share with you. Here, if you live in a civil way with all people, you will never go hungry. There only way anybody will go hungry in this village is if you don't have humility. In Borakalalo we take care of our poor, they even live better than people in Gauteng." (Respondents 22)

The quotation above also emphasises the role that social bonds and networks play in sustaining rural livelihoods in Borakalalo village. Villagers of Borakalalo have formed social bonds that support household livelihood sustainability (Ellis, 2000; Scoones, 1998).

Animals such as cattle and goats are mostly used for traditional slaughter, while animals such as sheep and pigs are mostly slaughtered mainly for their meat. Therefore, when sheep is slaughtered, it is mostly purely for the purpose of consuming meat or producing wool, and similarly, when pigs are slaughtered it is primarily for the purpose of consuming or selling meat. The nutritional benefits of sheep and pig slaughter outweigh the nutritional benefits of slaughtering cattle or goat for traditional purposes because, unlike when slaughter is for traditional purposes, the nutrition is not thinly spread across the community (Mafu & Masika, 2002; Wenhold *et al*., 2007).

Although there is very little production of leather goods in Borakalalo village, the villagers benefit by selling their cow skin to outsiders who come into the village specifically to purchase cow skin. The outsiders are said to come into the village mainly on Mondays and Tuesdays because most funerals, weddings or any other traditional ceremonies take place on weekends. By selling animal produce such as cow skin, households in Borakalalo village increase household monetary income (Swanepoel *et al*., 2010).

The benefits of livestock production are further amplified in low maintenance livestock, that is, livestock that is cheap to maintain (Smith, 1990; Wenhold *et al*., 2007). Scavenger chickens, for example, are a source of nutrition for 47% to 97% of households that are estimated to own 5 to 11 chickens in rural Eastern Cape. In Limpopo, on the other hand, 43% of households from two different settlements are said to own approximately 11 chickens per household (ARDRI, 2001; Bembridge, 1984; De Lange, 1991; Khosa, 2003; Steyn, 1988; Wenhold *et al*., 2007). Scavenger livestock is cost effective because very little money is invested into maintaining scavenging animals, but yet, the benefits yielded from owning scavenger livestock are both nutritiously and financially meaningful. Approximately a hundred eggs are produced for the purpose of selling and increasing the financial income base of rural households. Pigs are also highly productive scavenger livestock, and it is estimated that about 56% of households own at least two pigs. Additionally, pigs are normally slaughtered for the purpose of selling the meat, an act that is beneficial in increasing the monetary income of rural households (ARDRI, 2001; Bembridge, 1984; De Lange, 1991; Steyn, 1988; Wenhold *et al*., 2007).

A study conducted in Mantsie village revealed that regular droughts are observed by villagers in Lehurutshe. Livestock farmers in Borakalalo village shared about the devastating effects of the drought that was experienced roughly during the period of May 2013 to February 2014. Some livestock farmers, especially the poorest ones, lost a significant portion of their livestock investment during the drought period. Livestock farmers were forced to sell their livestock at a loss to commercial farmers, while some of the livestock died due to famine. Farmers who could afford to maintain livestock investment during the drought period complained about the total costs of maintaining livestock during droughts. For example, the cost of drought relief cattle feed (Lucerne) is more or less R40 per 50kg, and the cost of cattle salt is more or less R45 per 50kg. A cattle farmer who was able to maintain his livestock during the drought period estimates that the total expenditure of maintaining his cattle during this period was more or less R70000 for approximately 40 cows. For poor cattle owners, such costs were unbearable. As a result, commercial farmers saw an opportunity to buy cattle at a price less than what the cattle would usually sell for under different circumstances, whereby rural cattle owners are not pressed to sell due to

disadvantageous environmental conditions. The quotation below expresses the experiences of cattle farmers during the drought period:

"People lost their cattle, some people lost their cattle to death and some were forced to sell to big farmers, at a loss. They knew that people were desperate to sell and they took advantage of it. Many people just couldn't afford the cost of maintaining their cattle during the drought, so its people who are struggling who lost the most. Even though I managed to keep most of my cattle even through the drought, I can't deny that the cost of maintaining cattle during the drought was heavy even for me. I spent approximately R70000 during the drought on my cattle alone, some people just didn't have that kind of money, and unfortunately they were forced to sell their cattle at a cheap price." (Respondent 143)

Livestock prices are market related and, often subsistence farmers are not educated about favourable selling periods. Due to a lack of education about the business aspects of livestock production, rural farmers often sell at a loss to commercial farmers who are more educated about livestock trade and livestock market behaviour. Therefore, there is a need to educate rural subsistence farmers about livestock trade and, to enlighten them about the common trends in livestock markets in order for small farmers to make more informed decisions when selling or buying livestock. Considering that livestock farming plays such a vital role in the socioeconomic sustainability of rural livelihoods, the local government should play a role in protecting the livestock investments of rural households, especially during drought periods by providing aid to subsistence or emerging livestock farmers. To prevent extreme loss during droughts, it would be beneficial for rural livelihoods if the price of resources such as cattle feed and salt was to be subsidised for emerging rural farmers who cannot afford to maintain their livestock during droughts (Aliber & Hart, 2009; Shackleton *et al.,* 2010).

Although livestock has some cultural and social significance in rural South African communities and, it is also a good form of livelihood investment, there is a pressing need for rural communities to be educated about alternative forms of investment. The cultural importance of livestock still needs to be maintained, however, it would be less of a risk if rural household do not put most income investments into livestock. Education about banking and financial investments is required in Borakalalo village. Households that invest most income in livestock stand to lose most of the household investments when

environmental conditions are unfavourable for livestock herding. Cultural practises, as important as they are for maintaining social bonds in rural areas, need to be advancing in order to keep up with the ever changing physical environmental conditions. Culturally speaking, it is common practise to invest household income in livestock. Even so, these are changing times with the rapid changes observed in climatic patterns and the growing frequency of droughts in Lehurutshe and other regions across the continent. Cultural and traditional practises need to accommodate environmental changes if rural livelihoods are to survive. Although banking does not fall under the cultural norm in Borakalalo village, it may be necessary in preventing absolute loss of livelihood investments during droughts or other unfavourable environmental conditions (Ellis, 2000). A livestock farmer shared the following sentiments:

"People lose all their investments during droughts because they don't have a deep understanding of banking. Our logic is so cultural that you have to understand our culture in order to understand us. Almost every Setswana household has a cattle post, and to have a cattle post is dignity. When a drought comes, some people don't even think that they should sell some cattle so that they can have money to maintain the few cattle that they have remaining. They don't think like that because their cows are everything, and selling for them means that they are losing, even though they are not. The thought of selling and investing some of your money in a bank is something that does not register in the minds of many here. We are Batswana people, and our cattle mean everything to us, we are successful cattle farmers in almost arid conditions and we take a lot of pride in that, so when you come to us and tell us about banking, you are speaking a foreign language. I admit that it's that kind of mentality that needs to change because times are changing. When we as men come together, all we talk about is our cows and how many we have, so when you sell the number goes down, and for us that's never a good thing." (Respondent, 143)

In rural South Africa, it appears as though livestock farmers are more concerned with increasing their stock count rather than diversifying household investment. Furthermore, such traditional farming practices also do not allow stock rotation to take place. Most farmers do not allow livestock to rotate through selling old livestock in order to prevent loss. Old livestock could be replaced with new livestock, or even more advisable, money obtained through the sale of old livestock could be invested with a bank. Reducing livestock count is

referred to as destocking and, de Bruyn (1998) argues that the practise of destocking does not appeal to communal grazers in the former homelands. Furthermore, it is often argued that overstocking results in ecological degradation. There is a need for equilibrium between the number of stock and ecological capacity. In other words, the number of livestock should never exceed the capacity of the physical environment to sustain the livestock, either presently or in the long run. Good farming practices such as rotational grazing are not commonly practiced in rural areas and, emerging farmers tend to overgraze, resulting in environmental challenges such as soil erosion. Also, emerging farmers tend to overstock and do not adjust livestock number according to environmental conditions, perhaps through selling and reducing livestock number. Henceforth, rural livestock farmers would benefit from education about more productive and environmentally sustainable livestock farming methods that minimise loss of livestock investment through increasing capital investments in diverse forms of investment opportunities, as well as minimising impact of productive systems on natural resources (McGranahan & Kirkman, 2013).

5.5. The effects of water scarcity on water-related rural enterprises

Small businesses are crucial for addressing local development issues while contributing to national development at the same time. The effectiveness of small businesses in reducing unemployment and connecting the formal and informal economy is undeniable. However, even though small scale entrepreneurship plays a role in socioeconomic development, small businesses in South Africa continue to face growth preventing challenges. Difficulty in accessing funding, appropriate technologies, as well as training and support are some of the factors that prevent small businesses from flourishing (Agbenyegahn, 2013). In South Africa, 28% of the country's GDP and 75% of employment opportunities come from small businesses (Agbenyegahn, 2013; Wadala, 2005). Small businesses, more especially small businesses within the informal economy, are crucial for powering the rural economy through generating wealth and decreasing rural unemployment.

In Borakalalo village, 21% of respondents generate a livelihood mainly through the informal economy. While a total of 5% of households consider income generated through an informal business operation as the main source of income for those households. Furthermore, a total of 11 households out of the total sample of 150 households (7%) are currently generating an

income through a water-related business. Only 2 of the water-related businesses are formally registered businesses, while the remaining 9 businesses operate under the informal economy. In addition, more households continue to show an interest in small businesses, specifically water-related businesses, and a total of 3% of households that are currently not engaging with water for business purposes have expressed an interest in doing so.

Advocators of rural livelihood diversification often emphasise the importance of having rural households generate an income from multiple assets, utilising multiple capabilities. In other words, apart from traditional productive rural livelihood activities that rely heavily on the environment, such as agriculture and livestock herding, rural households should strive towards gaining a means of living through alternative livelihood activities. Therefore, small businesses are often encouraged in rural areas in order to diversify the income source base of village households. Traditional rural livelihood activities are important, but nevertheless, in order to achieve sustainable rural livelihoods, it is crucial that households be able to generate income through other means when natural resources are stressed and resource intensive activities such as agricultural and livestock production are under threat. Even though livelihood diversification is crucial, some households are successful in diversifying livelihood capabilities, that is, activities performed to generate an income, but unsuccessful in diversifying the household resource base. Strictly speaking, a household may make use of different capabilities, however, although the capabilities may vary, those different capabilities may depend on the same asset in order to generate an income (Bebbington, 1999).

Households in Borakalalo village are taking the initiative of diversifying into small businesses (more especially informal businesses) as a means of generating a livelihood. It is all the same though because some of the businesses that households have diversified into are water-related businesses, and ultimately, although households have successfully diversified into other livelihood activities, the households have not diversified into other assets. In this case rural households still remain heavily reliant on natural resources. Just like livestock or agricultural production, water-related businesses need water in order to operate, and thus, very little asset diversification is taking place when households diversify into water-related businesses. In addition, some of the identified water related businesses, mainly the car wash, the ‘Shisanyama’ restaurant, the hair salon and the construction business, are water

intensive businesses. The dependence on water that households in Borakalalo village demonstrate in this study stretches so deep that even some businesses in this village are threatened by water shortages (Chambers & Conway, 1991).

Scholars such Pollard *et al.,* (2002) realise that apart from domestic activities, there are productive water-dependent activities that most rural households often engage with. However, what is often not mentioned are water-dependent services that are provided in rural areas. In other words, water in rural areas is not just used in productive livelihood activities, but also, some service orientated water-related business activities are also evident in rural areas. In Borakalalo village, water-dependent business services that are provided include: gardening, a car wash, a tavern, a Shisanyama and a hair salon. Furthermore, 3 of the 4 households that have expressed an interest in engaging with water-related businesses have expressed interest specifically on service businesses. Potential service businesses of interest include: a crèche, a cleaning company and a Laundromat. There is evidence of interest in service providing water-related businesses more than productive water-related businesses. Henceforth, when considering the role of water in supporting rural livelihoods, it is crucial that not only productive livelihood activities be considered, but also, service providing water-related businesses should receive due attention. It appears as though rural economies are on track with the trend in the broader South African economy, in which the service sector is growing and fast becoming the biggest generator of employment (SEDA, 2012).

According to Argent (2002) and Wilson & Rigg (2003) the rural economy has shifted from a productivist to a post-productivist era. The former is characterised by an expansion of productive economic activities such as agricultural production. Divergently, the latter refers to an era whereby rural economies focus more on making a profit from the social meanings and sentimental attachments to rural spaces. Such a shift in focus has resulted in the emergence of a service sector and, most identifiable is the growth of the rural tourism industry. The extension of the tourism industry also brings forth the growth of other service industries such as cleaning services for holiday homes, restaurants and transport businesses. In line with the progression of rural economies of the world, a switch from productivist to post-productivist economic activities is also evident in Borakalalo village. One of the respondents in this survey expressed an interest in maintaining second homes of urban

migrants who leave their rural homes in Borakalalo village. The respondent was interested in providing housekeeping services, specifically through cleaning second homes of urban migrants. The quotation below amplifies the growth of post-productivist services in Borakalalo village:

"There are lots of people in the village who own houses here but work elsewhere and they only come home a few times in a year. Most of these people need people to care for their houses while they are gone. I want to be able to clean these people's houses and have them pay me." (Respondent 11)

The owner of 'X tavern' shared that the tavern is visited by people from different parts of the province, other parts of the country and from outside the country. Therefore, it is clear that 'X tavern' is a tourist attraction, and hence serves as evidence of the emerging tourism industry in Borakalalo village. The growth of the tourism industry in the village has increased water demand for other tourism related services.

Water scarcity in Borakalalo village is localised to the point that different sections of the village experience water scarcity at different degrees. Households in high-lying sections of the village, where prolonged water cuts are experienced, are sometimes faced with empty Jojo tanks. Also, low-lying sections where periodic water cuts are experienced face the challenge posed by water scarcity. In one section of the village, mostly in low-lying sections of the village where water cuts are periodic and not prolonged, running tap water may be available, while on another section of the village, also in a low-lying section of the village, there might be no running tap water. If periodic water cuts are experienced on one section of the village, households may turn to community taps in another section of the village. If the nearest Jojo tank is empty, households may turn to the second nearest Jojo tank. When most Jojo tanks are empty, households in high-lying areas that depend mainly on Jojo tanks will then turn to community taps in low-lying sections of the village. Due to the unpredictability that comes with accessing water in Borakalalo village, sometimes households may even turn to community taps in other sections of the village or water deliverers. The spatial and temporal variability of water scarcity in Borakalalo village supports the argument made by Rosbjerg *et al.,* (1997) who states that because water is not a static resource, but rather, a dynamic and unpredictable resource, water scarcity tends to

be localised. An area may experience water scarcity for months and go on to experience abundance in water supply the next month. Water scarcity is difficult to track down and, just like water itself, water scarcity is not a constant phenomenon. Instead, water scarcity moves and takes on different forms from region to region, in some regions water scarcity is seasonal and in other regions it is prolonged. In upper-lying sections of Borakalalo village water scarcity is prolonged while in lower-sections of the village water scarcity is periodic. It is therefore difficult for global studies on water scarcity to fully represent the degree of water scarcity on a local scale and the extent to which rural communities are affected by water scarcity (Vörösmarty *et al*., 2000).

Businesses in Borakalalo village that depend on the availability of water in order to operate have recorded decreased business productivity and a decline in profits due to water shortages. However, challenges posed to businesses and households in Borakalalo village have resulted in the emergence of a new kind of service business. The rise of water deliverers in the local informal economy is a response to the economic gap caused by water shortages in the village. Water deliverers take away the burden of having to ensure access to water from households and businesses, and in return, households and businesses pay water deliverers for their services. In contrast to water-dependent service providing businesses in the village, delivering water can be described as a water scarcity dependent business service. Unlike water-dependent businesses that need water in order to operate, the survival of water scarcity dependent businesses depends on the continuation of current water shortages in the village. Water scarcity has created business opportunities that would otherwise not exist if Borakalalo village was not experiencing water scarcity (Chambers & Conway, 1991).

Agbenyegahn (2013) argues that small enterprises are vulnerable to various challenges that endanger the existence of small businesses. In Borakalalo village, 5 out of the 11 water-related businesses (42%) have poor water scarcity management capacity. In other words, these businesses are highly vulnerable to water scarcity. Due to the sensitivity of small rural businesses to challenges, external support for rural businesses from the local government and other stakeholders is necessary. A study conducted in the rural Northern Cape Province revealed that there is a lack of support for rural businesses from local district municipalities, and also a lack of government support was revealed in that particular study. Additionally,

small rural businesses exhibit an absence of small business education, there is often also a lack of start-up capital for small businesses, resulting in micro enterprises experiencing financial challenges (Agbenyegahn, 2013). As noted in the 1995 white paper on the Development of Small Business "*The stimulation of SMMEs must be seen as part of an integrated strategy to take this economy onto a higher road – one in which our economy is diversified, productivity is enhanced, investment is stimulated and entrepreneurship flourishes"* (O'Neill & Viljoen, 2001:37; White Paper, 1995:5). Nonetheless, state support for SMME's is yet to extend into rural areas as noted in the study on small rural businesses in the Northern Cape, where support for SMME's in rural parts of the province is lacking. When faced with the challenge of water scarcity, small rural businesses do not receive the necessary support from external government entities or other stakeholders, resulting in water-related small businesses in Borakalalo village losing profits. Small businesses often do not have the necessary resources to respond to external stresses such as water scarcity, and it is for this reason that small businesses require external support in coping with such challenges. Small business owners, as discovered in the empirical study conducted in rural Northern Cape, are often not educated about business management, and thus, one could argue that rural entrepreneurs do not have adequate knowledge and skills on how to manage a business through various economic or environmental conditions.

A total of 5 out of the 11 water-related businesses in this investigation are businesses owned and controlled by women. There is thus a specific need for support of female rural entrepreneurs. The advancement of women in business sectors is essential for realising goals stated in the 1995 White Paper, which lists gender equity through creating equal economic opportunities, specifically entrepreneurship opportunities for women, as a pivotal goal in the support framework of the national small-business policy (White Paper, 1995; O'Neill & Viljoen, 2001). Findings suggest that male-owned businesses outnumber female businesses. As evident in this investigation, there are more male entrepreneurs than there are female entrepreneurs in Borakalalo village (O'Neill & Viljoen, 2001). There are a number of challenges facing female entrepreneurs, one being a lack of recognition of the role of female entrepreneurs in developing economies. Furthermore, the limited capacity that woman have in accessing financial resources, entrepreneurial skills training and technology, inhibit the advancement of female-owned businesses. Women also struggle in penetrating

male dominated business sectors (such as agricultural and livestock farming) and keeping business track records as well as challenging the legal status of women. Women, more especially married women, normally have family commitments that are prioritised over entrepreneurial duties. Considering all the challenges faced by female entrepreneurs, there is a pressing need for greater support for female entrepreneurs, more especially rural female entrepreneurs who play an important role in generating rural livelihoods (Mkhize, 2013).

5.6. Factors hindering access to water in Borakalalo village

Borakalalo village suffers from both physical and economic water scarcity. As highlighted in the study on climate change conducted in Mantsie village in Lehurutshe district, frequent droughts and reduced rainfall are observed by the residents of Mantsie (Francis, 2002; Herrero *et al*., 2010; Molden *et al.,* 2001; Thomas *et al.,* 2006). Also, residents of Borakalalo village complain about poor water quality (specifically about muddy tap water). It should be noted that poor water quality is a contributing factor to physical water scarcity. On the other hand, poor, damaged and unmaintained water infrastructure in Borakalalo village leads to economic water scarcity (Falkenmark *et al*., 1989; Sullivan *et al*., 2003; Tyler and Miller, 1996; Winpenny, 1999).

Matshel *et al*., (2013) notes that in most cases, communal taps in rural South Africa are not well maintained and thus, most villagers are often forced to collect water directly from unsafe sources. In rural areas environmental problems such as the mismanagement of waste, mismanagement of livestock, poor water resource management and land degradation are some of the factors that contribute to poor water quality. Consequently, the act of directly collecting water from sources such as rivers and dams, often practised in rural South Africa, exposes villagers to water of unacceptable quality according to the water quality parameters set by the South African Quality Guidelines and the South African Bureau of Standards (DWAF, 1996; Momba *et al.,* 2002; Momba *et al*., 2006; SABS, 2001). In addition, in most rural parts of South Africa it is often the responsibility of individual small water systems to supply water. However, studies reveal that small water works often have difficulty in providing adequately treated and disinfected water. Henceforth, the rural population is often on the receiving end of poor quality water, putting them at risk of water-

borne diseases (Mackintosh & Colvin, 2003; Momba *et al*., 2006; Swartz, 2000). Small water treatment plants often do not have the technology, finances and well trained plant operators required to successfully deliver adequately treated water to communities served by such micro water treatment plants. Rural communities are often small and do not have a large customer base to generate sufficient revenues to manage or upgrade treatment facilities or to hire skilled and experienced plant operators and managers. Therefore, as revealed by a study conducted in rural parts of the Eastern Cape Province of South Africa, most small water treatment plants fail to deliver water that meets the quality standards set by the South African Quality Guidelines and the South African Bureau of Standard (Momba *et al*., 2006).

In Borakalalo village 26% of households (39 out 150 households) have expressed discontentment about the quality of tap water. Often, households in Borakalalo village are on the receiving end of muddy tap water. Residents of Borakakalo village have shared that poor, or rather, questionable water quality (mainly muddy water in this instance) is one of the factors limiting them from utilising water for multiple purposes. The muddy brown water that often comes out from taps in Borakalalo village is not used for physical consumptive purposes by most households in the village. Rather, most households prefer to use this water for productive but not consumptive purposes. For a total of 26% of surveyed households that are often the recipients of muddy tap water, the issue of muddy water normally persists for less than a week. Another 64% of households surveyed experience muddy tap water for a full week at most, while 10% of households tend to be on the receiving end of muddy tap water for up to two weeks. The following statement expresses the displeasure about the quality of running tap water in Borakalalo village:

"Sometimes our tap water is brown because of mud. I was told that it's actually safe to physically consume this water and that it's harmless. My question to these people who say that this water is safe is this: do they drink muddy water, or is this water just safe and harmless when it comes to us villagers? I think it is an insult to us as a people, we want clear water and we don't want to be told about the safeness of muddy water, we don't want to be treated like children." (Respondent 22)

Another factor that inhabits access to water in Borakalalo village is damaged water infrastructure. A common infrastructural problem that is observed by the residents of Borakalalo village is damaged community taps. Overall, a total of 13% of households surveyed in this study (20 out of 150 households) have been victims of damaged community taps. In South Africa, it is the responsibility of the Water Service Authority (WSAs) to set out a plan for the provision of water services at local government level, in accordance with the Municipal Structures Act of 1998 (Matshel *et al*., 2013). It has been observed by Harshfield *et al*., (2009) that although the WSAs or the municipality is responsible for distributing and maintaining water infrastructure in rural communities, there is often evidence of failure in maintaining water infrastructure in nonurban areas. Furthermore, the distribution of water to communal or in-dwelling taps in rural areas is in many occasions infrequent. Irregularities demonstrated in the provision of water in Borakalalo village commonly results in residents not being able to access water due to empty Jojo tanks, as well as periodic and/or prolonged water cuts. A total of 19% of surveyed households (26 out of 150 households) have had the unfortunate experience of not being able to access water due to empty Jojo tanks in the village. Jojo tanks are meant to be a mitigation strategy for the water crises currently being experienced in Borakalalo village. Instead, due to inconsistencies in the delivering of water to Jojo tanks in the village, it seems as though the introduction of water tanks has not successfully lessened the severity of the impacts of water scarcity on households in Borakalalo village. Additionally, for a total of 58% of surveyed households (87 out of 150 households) periodic piped water cuts reduce household capacity to access water. Prolonged water cuts, on the other hand, prevent access to water for a total of 63 out of 150 households (42%) that were surveyed.

5.7. Conclusion

The discussion chapter highlights the key issues revealed in this investigation. The important social and economic role played by conventional productive rural activities such as livestock herding and agricultural crop farming is brought to light. Even more, the rise of productive water-related rural enterprises, and the role of such small businesses in generating a livelihood income cannot be ignored. The discussion chapter also reveals the growth of the service sector in Borakalalo village.

Subsistence agricultural production decreases financial pressure on households by decreasing the total monetary income expenditure on food. Livestock farming, on the other hand, is useful for creating social networks, diversifying nutritional intake of rural dwellers, creating livelihood investment and, when well managed productive animals provide a variety of environmental services for the rural landscape.

Water-related businesses in Borakalalo village are also threatened by water scarcity, and as a result, the livelihood sustainability of households that depend on water-related businesses is under threat. There is also potential for economic growth through entrepreneurship, however, some of the prospective businesses are put on hold due to current water shortages in the village. It could be argued that water scarcity is limiting economic growth in Borakalalo village. Growth in the service sector in Borakalalo village is also observed, mainly through an expansion of the tourism industry and all services linked to tourism. Water in Borakalalo village does not only serve productive businesses, instead, water also serves in the service sector. Although growth is already evident in the service sector, further potential growth is also limited by current water shortages in the village.

Chapter six: Conclusion

6. Introduction

The aim of this research was to expose the effects of water scarcity on rural livelihoods through a case study of Borakalalo village in Lehurutshe district (North West of South Africa). The main argument presented in this thesis is that there is a lack of knowledge about the effects of water scarcity on rural livelihoods and that, studying and understanding the water usage patterns of rural households is a key component in unpacking the impacts of water scarcity on rural livelihoods. The final chapter of this thesis will give an overall conclusion on some of the key findings in this investigation.

This research is based on a theoretical claim that there is a lack of understanding about the role of water in sustaining rural livelihoods. The range of water-related activities that rural dwellers engage with in order to generate a livelihood are not well documented, and thus, it is difficult to establish how water scarcity affects the livelihoods of rural households (Butterworth *et al*., 2003; Dlamini, 2007; Mokgope & Butterworth, 2001; Mokgope *et al*., 2001; Moriarty & Butterwoth, 2003). Water provision to rural households in South Africa has often focused on providing water for domestic activities. While on the other hand, the allocation of water for productive activities has been neglected. There is an assumption made that current basic water supply parameters, such as the BHNR, are sufficient in meeting the water needs of rural households.

This chapter will discuss some on the main themes and key findings in this study. The first section will discuss identified past, present and potential water usage trends. A brief comparison between past and present water usage patterns will be useful in identifying how villagers in Borakalalo have altered household water usage patterns in response to the rise of water scarcity. Highlighting the role of identified water-dependent activities in generating a livelihood income for households in Borakalalo village will expose the level of water-dependence of households in Borakalalo village. Additionally, uncovering potential water usage patterns will reveal whether there are water-related activities that households in Borakalalo village would like to engage with if water was more easily accessible to them. The second sections of this chapter will briefly explore some of the factors that constrain access to water in Borakalalo village. Thereafter the third section will give recommendations

for addressing major challenges limiting access to water and threatening livelihood sustainability as identified in this investigation. The final section will make some suggestions for future research in order to address some of the pressing questions that this research was not fully suitable to respond to.

6.1. Past, present and potential water usage patterns in Borakalalo village

This investigation revealed that households in Borakalalo village use water for four main categories of water-dependent activities, namely: domestic, agricultural, livestock and micro-business activities. Changes are visible in the water usage trends of households in Borakalalo village and, changes seem to suggest that residents have responded to the plight of water scarcity by altering household water usage patterns. Some households have stopped participating in livestock and agricultural production due to increased water shortages in the village.

Under past water usage trends, which is any time before water shortages began to trouble the village of Borakalalo, more than half of the surveyed households were using water for a diverse range of activities and not strictly for domestic activities. Prior to 2010 when periodic water cuts began to challenge access to water in the village, only 39% of households were using water solely for domestic activities. Whereas, currently the percentage of households that engage with water solely for domestic purposes has increased to 55%. Since the beginning of trials caused by water scarcity in Borakalalo village, households have discontinued engagements with a variety of water-dependent activities and concentrate mainly on utilising water for domestic activities. A decline in the use of water for crop agricultural activities from 35% to 22% of the surveyed households is identifiable. Also observed is a drop in the use of water for livestock production from 45% to 39% of sampled households. The use of water for water-related business activities has however remained constant. Under potential water usage, 20% of households presently not engaging with livestock production have expressed an interest in participating in this livelihood activity. A total of 25% of households not presently engaged with agricultural activities have expressed an interest in doing so, while 3% of households currently not using water for business purposes have expressed an interest in engaging with water-related business enterprises if water was consistently available. It is thus evident that water scarcity

has affected the water usage trends of rural dwellers in Borakalalo village, and also continues to limit the range of water-related livelihood activities that households in the village choose to engage with.

Borakalalo village is shifting from productivist to post-productivits economic activities, and as a result, growth in the service sector of the village is visible. A total 3 of the 4 households that have expressed an interest in engaging with water-related businesses have expressed interest specifically on service businesses. Growth of the service sector has increased the demand for water in Borakalalo village and, growing water shortages pose a threat to the expansion of the service sector. Although most scholars acknowledge that water is used for productive rural enterprises, there is little exploration of how water benefits service enterprises in rural areas.

This investigation probed the effects of observed changes in the water usage trends of households in Borakalalo village on household livelihood sustainability. One of the key themes discussed is that decreased agricultural production puts pressure on the monetary income of households in Borakalalo village. Households that no longer engage with agricultural activities now have increased financial expenditure on food. Unfortunately households in Borakalalo village have low levels of employment, with 21% of households dependent on social grants and 21% of households that do not have a steady financial income, thus agricultural production plays a role in increasing food security in the village. Crop farming reduces the total monetary expenditure on food. Therefore, reduced agricultural production in Borakalalo village is a threat to livelihood sustainability (Wenhold *et al*., 2007). In total, 20% of households view agricultural production as a 'very important' livelihood activity for maintaining household livelihood sustainability. For households that view agricultural production as a 'very important' livelihood activity, agriculture is an irreplaceable livelihood activity for maintaining livelihood sustainability. On the other hand, 8% of households view livestock farming as a 'very important' livelihood activity. Livestock is useful for diversifying the nutritional intake of rural dwellers. It is common practise in rural South Africa for most villagers to produce high volumes of the same crops and, it is this popular mono-cropping practise that limits the nutritional intake of rural dwellers (McDermott *et al.,* 2010). Therefore, animal based foods provide much needed nutritional

diversification in rural areas. The various environmental, social and economic services provided by productive animals are also pivotal for sustaining rural livelihood

6.2. Factors constraining access to water in Borakalalo village

Borakalalo village suffers from both economic and physical water scarcity. Thus, physical factors such as reduced rainfall and regular droughts, as observed in a study on climate change in Lehurutshe district, have contributed to physical water scarcity in Borakalalo village (Francis, 2002; Herrero *et al*., 2010; Thomas *et al.,* 2006). Sehujwane dam, which provides water to Borakalalo and some of the surrounding villages, has a capacity of 0.839 million m3/a while the calculated water requirements for these villages is 0.850 million m3/a (*Ngaka Modiri Molema District Municipality & Ramotshere Moila Local Municipality,* 2011). In addition, the questionable quality of piped water in Borakalalo village also contributes to physical water scarcity. In terms of economic water scarcity, the poor maintenance of water infrastructure, specifically the maintenance of community water taps, hinders access to water for households in the village. Water scarcity in Borakalalo village varies from one section of the village to the next. Some areas of the village suffer from prolonged water cuts, mainly upper-lying sections of the village, while low-lying section of the village suffer from periodic water cuts. As a result, mainly households in lower-lying sections of the village have managed to maintain engagements with a diverse selection of water-related activities, while most households in upper-lying sections of the village have been forced to cut back on some water-related livelihood activities. Therefore, the effects of water scarcity on households in Borakalalo village are spatially and temporally variable even within the village itself (Rosbjerg *et al.,* 1997).

Jojo water tanks that have been strategically placed in some sections of the village are an attempt from the municipality to mitigate effects of water scarcity on households in Borakalalo village. Nonetheless, water Jojo tanks have been received with high levels of ambivalence by most residents of the village. Subsequently, some households go through great lengths to avoid water from Jojo tanks and, prefer to have piped water directly from the tap delivered by water deliverers instead. It is thus argued in this thesis that water scarcity mitigation strategies in Borakalalo village need to take more of a bottom-up approach in addressing water scarcity. A bottom-up approach of involving the community in

the design and implementation of a mitigation strategy could have been more effective in coming up with a mitigation strategy that satisfies both the local authority and the residents of Borakalalo village (Dirix *et al*., 2013).

Water scarcity has also resulted in the emergence of a new kind of business opportunity for water deliverers. Water deliverers are responsible for supplying piped water to households, mainly households that are dissatisfied with the quality of water from Jojo tanks in upper-lying sections of the village. Delivering water is a water scarcity dependent business due to the fact that in order for this kind of business to continue operating, present water shortages in the village must also continue. There is therefore a clash between small businesses in the village that are threatened by water scarcity and, the emergence of businesses that depend on the continuation of current water shortages in the village.

6.3. Recommendations for addressing water scarcity and protecting livelihood sustainability in Borakalalo village

There is a pressing need for interventions that will assist livelihoods in Borakalalo village withstand threats posed by water scarcity. Therefore, this section will provide some short-term and long-term recommendations for addressing water scarcity, protecting and enhancing household livelihood sustainability in Borakalalo village.

Findings in this investigation indicate that water scarcity in Borakalalo village has reduced the number of households that interact with water for productive livelihood activities such as agricultural and livestock production. Also, water shortages in the village continue to threaten existing small water-related businesses enterprises. The potential for Borakalalo village to expand in the tourism and services industry is limited by water scarcity. Moreover considering the high unemployment, low education/skills training and the heavy reliance on social grants in Borakalalo village, it can be argued that most households in the village do not have the capacity to effectively respond to water scarcity. In other words, general household livelihood resilience in Borakalalo village is low, and thus, most household livelihoods are threatened by water scarcity. Rural areas are trailing behind in social and economic development (Phillip, 2010). For this reason, a lack of access to assets such as education and employment, for example, as observed in the case of Borakalalo village, makes rural livelihoods directly dependent on natural resources.

This research disclosed that 20% of respondents view agricultural production as a 'very important' livelihood activity for maintaining household sustainability. However, even though agriculture is a 'very important' and irreplaceable livelihood activity for 55 out of 150 households, 73% of households have poor water scarcity management capacity with regards to agricultural production. What this particular finding means is that 73% of households in Borakalalo village fail to effectively manage the threat posed to agricultural production by water scarcity. Henceforth, there is a need for interventions that will assist maintain agricultural production. The following suggestions will be useful in maintaining agricultural production and thus increase livelihood sustainability:

- Centralising agricultural production into a few major community gardens rather than having households concentrate on individual household gardens would boost agricultural production. Irrigation water can be delivered to a few centralized points, in this way, agricultural production through communal gardens can continue to benefit households in Borakalalo village. Communal gardening will decrease pressure of having to ensure access to irrigation water at different points of the village for different households. Community agricultural projects can also create opportunities for households to generate a monetary income and increase disposable income (Nkosi *et al*., 2014).
- There is a need to increase support for agricultural production from local government authority in Borakalalo village, mainly through creating a platform for agricultural education and skills development, such as organic mulching in order to counter the effects of water scarcity. Also, improved access to necessary equipment and resources such as land, water, seeds and pesticides is essential in improving agricultural production (Aliber & Hart, 2009).
- The feminization of agriculture through prioritizing agricultural skills training for women will be effective in reducing food insecurity in rural areas. Due to urban migration, women are often left behind in rural areas with the responsibility of securing a livelihood for their families and, as a result, there is a need for women to gain more authority in the agricultural sector through promoting access to agricultural skills, equipment and resources for women (de Schutter, 2013; FAO,

2010; FAO, 2011; Hart & Aliber, 2012; Moghadam, 2015; Lastarria-Cornhiel, 2008; Philip, 2010).

Opinions about livestock production in Borakalalo village seem to suggest that livestock farming is valued less than agricultural farming, with only 8% of respondents expressing that livestock production is a 'very Important' livelihood activity for maintaining livelihood sustainability. Contrary to the opinions held by most respondents about the role of livestock production in maintaining livelihood sustainability, there are more households currently participating in livestock production than there are households engaging with agricultural farming and, this is a trend that has continued from past to present water usage patterns of households of Borakalalo village. A total of 74.3% of households have limited or poor capacity to manage threats posed by water scarcity to livestock production. The following recommendations will be useful in stimulating and protecting livestock production in Borakalalo village:

- Education on sustainable livestock farming practices such as stock rotation and rotational grazing is required in Borakalalo village. This kind of environmental education is a long-term solution to environmental problems. Environmental education will equip emerging farmers with skills that will allow them to become environmentally sustainable in their farming practices in order to avoid the exacerbation of environmental challenges associated with climate change, such as water scarcity (Bruyn, 1998; McGranahan & Kirkman, 2013).
- There is a need for the government to subsidize the costs of maintaining livestock for rural emerging livestock farmers during periods of drought. The loss of livestock during droughts results in loss of all, or most, of livelihood capital investments for some households in rural areas (Aliber & Hart, 2009).
- There is a need for education about alternative methods of investing livelihood capital, more especially education about formal banking systems. This form of education may help minimize the impact that environmental challenges (such as water scarcity) have on livelihood investments, especially investment in the form of livestock. Residents of Borakalalo village could prevent absolute loss of household investments by concentrating on diverse forms of livelihood capital investment, rather than just investing all household income in resources that are sensitive to

environmental changes. There is a need for livelihood diversification (Bebbington, 1999, McGranahan & Kirkman, 2013).

- There is also a need to protect rural subsistence livestock farmers by educating them about livestock markets. Knowledge about livestock markets will prevent subsistence farmers from committing the mistake of selling livestock during unfavorable periods in the market, and thus often selling livestock at a loss.

Water-related businesses contribute a livelihood income to 7% of households in Borakalalo village. It is also concerning that 42% of existing water-related businesses do not have the capacity to effectively respond to water scarcity. Hence the existence of 42% of water-related businesses is highly threatened by present water scarcity in Borakalalo village. Water scarcity also limits the expansion of the tourism industry and other service businesses in Borakalalo village. The following recommendations will protect water-related businesses and livelihoods dependent on water-dependent enterprises:

- There is a need for local government to increase support for small businesses, especially during environmentally challenging periods. Skills training on business management under various economic and environmental conditions would benefit business owners in Borakalalo village. State and NGO support should promote access to finances, natural resources such as water where necessary (like in the case of water-related business in Borakalalo village). Access to technology, information and skills training is also a crucial component of ensuring the sustainability of small rural enterprises (Agbenyegahn, 2013).
- Furthermore, the feminization of rural economies as a whole is of paramount importance. Women are also gaining access to different kinds of rural economic activities, for example: there is evidence of female entrepreneurs in rural areas and, 5 out of the 11 water-related businesses noted in this research project are owned and operated by women. Therefore, there is a need for NGO's that support female entrepreneurs in rural areas, as well as a need for local state authority to promote and support female entrepreneurs (Mkhize, 2013).

In order to lessen the severity of water scarcity in Borakalalo village, Jojo water tanks have been strategically placed at different points in the village. Jojo water tanks were meant to

ensure access to water by compensating for interruptions in the piped water supply. However, evidence in this study suggests that the current water scarcity mitigation strategy has not been well received by most residents of the village. Jojo water tanks have not reduced the challenge of accessing water for most residents of Borakalalo village. The main reasons for observed failure in efforts to minimize the effects of water scarcity by introducing Jojo water tanks are: infrequent water delivery to Jojo tanks, dissatisfaction about the quality of water in Jojo tanks and distrust due lack of information about the source of water from Jojo tanks.

Poor management of water infrastructure and poor water quality (muddy tap water) also contribute to water scarcity in Borakalalo village, hence it is evident that reasons behind current water scarcity in Borakalalo village are both physical and economic. Physical factors that contribute to water scarcity in this part of the world are: poor water quality, decreased rainfall and frequent droughts in the region. While economic factors that fuel water shortages in the village are: poorly managed water infrastructure and infrequent delivery of piped water. Recommendations for increasing access to water in Borakalalo village are as follows:

- Support for water deliverers from the local state authority in order to increase efficiency of this kind of water delivery system. Water delivery via water deliverers is preferred over Jojo water tanks in Borakalalo village.
- Creating a platform for residents to monitor and report damaged community water taps. Residents need to be educated about procedures of reporting service delivery grievances. Once the service provider is frequently informed of any infrastructural problems directly from the residents, these kinds of infrastructural challenges can be addressed promptly.
- Create a platform for residents to report empty Jojo water tanks, in this way water delivery into Jojo water tanks can be more frequent.
- Improve access to information and knowledge about water scarcity. Educational workshops on successfully responding to water scarcity, protecting livelihood sustainability and on effective water management would benefit households in Borakalalo village.

- Keep a constant flow of information about progress made, or lack thereof, in addressing water scarcity from the local government to the community. Residents of Borakalalo village expressed that they were 'kept in the dark' about water scarcity in the village.

6.4. Recommendations for future research.

There are some issues identified in this investigation that require further research. The purpose of this section is to recommend some important issues that were not fully addressed in this thesis for additional research. The following issues still need to be carefully scrutinised in future research:

- The role of water in a post-productivist rural economy. Research often focuses on the role of water in a productivist rural economy, whereby water is used for productive livelihood activities. However, further research is needed on the extent to which water serves rural communities in the expansion of the service sector and, the limitations that water scarcity poses in the emerging shift from productivist to post-productivist rural economies.
- The role of state and civil society engagements in rural South Africa. Research on the relationships between the state and civil society in the urban context is extensive. Research on how various civil movements play a role in shaping urban experiences and raising dissatisfactions, mainly dissatisfaction about service delivery through public protests that are a constantly observed in urban areas of South Africa, is extensive and detailed. However, there is very little understanding about the ways in which rural communities go about communicating with the state, and the kinds of platforms that exist for rural dwellers to raise grievances, make recommendations or give compliments to the state are not fully understood.
- What kind of potential exists for the feminization of rural economies in Borakalalo village and, the implications that increased support for a female rural workforce or female entrepreneurs could have on livelihoods of Borakalalo village.

6.5. Conclusion

The water usage patterns of rural households are not well documented. As a result, there is very little knowledge about how water scarcity affects rural livelihoods. In other words, there is little known about the range of livelihood activities that rural households engage with, and hence there exists a certain level of incomprehension about the extent to which rural activities are threatened by water scarcity.

In order to understand the effects of water scarcity on rural livelihoods, it was necessary that this study looks at past, present and potential water usage patterns in Borakalalo village, in order to unpack the ways in which water scarcity has impacted how villagers of Borakalalo engage with water. Responses to water scarcity are evident in the water usage patterns of households in Borakalalo village and some households no longer engage with productive livelihood activities. Furthermore, exploring the role of productive livelihood activities in generating an income was helpful in revealing how changes in the water usage patterns of households in Borakalalo village have affected livelihoods sustainability. Strictly speaking, the value of productive water-related rural livelihood activities in maintaining household livelihood sustainability was scrutinised. After considering the role of various water-related livelihood activities in generating an income, this study was able to uncover the threat of water scarcity on water-related activities, and thus also uncover the threat of water scarcity on rural livelihoods.

The results in this investigation suggest that rural livelihoods are highly dependent on productive water-related activities. Therefore, a threat to productive water-related activities is a direct threat to livelihoods in Borakalalo village.

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Appendix 1

Consent Form for participation in semi-structured interviews

You are invited to participate in this research process by participating in semi-structured audio-taped interviews with the researcher. ***All information you share with me will be treated as confidential and all data will be destroyed at the end of this research****. Please note that you are not in any way forced to participate in this research, you have every right to refrain from participating in this research. If you wish to stop participating in this research at any point during the interview, please do not hesitate to inform the researcher and your wished will be respected.*

Thank you for your participation.

Lydia Tabane,

School of Geography, Archaeology and Environmental Studies (University of the Witwatersrand)

Name of participant: ……..

Date: ……..

Signature: ……..

Consent Form for Audio-taping of Interviews

I …… hereby willingly consent to the taping of my interviews as part of the research on the effects of water scarcity on rural livelihoods. I understand that all taped data will be destroyed. I also understand that I will remain anonymous.

Date: ……..

Signature: ……..

Appendix 2

Semi-structured interview guide (To be completed by researcher)

The effects of water scarcity on rural livelihoods: A case study of Borakalalo village in Lehurutse (North West Province)

Interview guide House number_____ (Remains anonymous)

1.1. Assessing the structure and socioeconomic sustainability of participating households

Are you a permanent member of Borakalalo village? (Continue to next question only in the response to this question is yes).

Yes ☐

No ☐

Are you a permanent member of your represented household? (Continue to next question only in the response to this question is yes).

Yes ☐

No ☐

Gender

Male ☐ Employed ☐

Female ☐ Unemployed ☐

If employed, please state what you are employed as or elaborate on what your job entails (Profession).

_____

_____

Have you ever been employed? (If unemployed) Age _____

Yes ☐

No ☐

If yes, how many years back were you employed and for how long?

_____

_____

In your previous job, what were you employed as? (Profession)

_____

_____

What is your role in this household?

Economic role: _____

Social role: _____

How many members are in this household? _____

What are the ages of the members in your household (living with you)?

	<6	7-12	13-18	19-30	31-30	41-50	51-60	61-64	>65
Adult 1	1	2	3	4	5	6	7	8	9
Adult 2	1	2	3	4	5	6	7	8	9
Adult 3	1	2	3	4	5	6	7	8	9
Child 1	1	2	3	4	5	6	7	8	9
Child 2	1	2	3	4	5	6	7	8	9
Child 3	1	2	3	4	5	6	7	8	9
Child 4	1	2	3	4	5	6	7	8	9
Child 5	1	2	3	4	5	6	7	8	9
Child 6	1	2	3	4	5	6	7	8	9
Child 7	1	2	3	4	5	6	7	8	9
Other	1	2	3	4	5	6	7	8	9
Other	1	2	3	4	5	6	7	8	9

In total, how many male and female members do you have in this household?

Male_____

Female_____

What is your highest level of a formal skills or academic qualification?

Formal skills training: _____

Academic: _____

Have you had any informal skills training in any field?

Yes ☐

No ☐

If yes, what is the skill that you received informal training in?

_____

_____

Do you use that skill to make money or have you ever used that skill to make money before? (Applicable only if you have received informal skills training)

_____

_____

What is the highest level of a formal education that any member of this household has obtained?

Formal skills training: _____

Academic: _____

What is your main means of generating an income?

_____

_____

Do you have other means of generating an income?

Yes ☐

No ☐

If yes, what other means do you use to generate an income?

_____

_____

Are there any other members in the household who generate an income?

Yes ☐

No ☐

If yes, how do they go about generating that income?

_____

_____

Are you a recipient of a social grant either for yourself or on behalf of someone else?

Yes ☐

No ☐

If yes, please state what the social grant you receive is for?

_____

_____

If there are children in this household, please tell us what their daily duties/chores entail?

_____

_____

Why are the duties/chores performed by children in your household important/unimportant?

_____

_____

1.1.1 Assessing tangible assets of the household

Do you own livestock?

Yes ☐

No ☐

How does the livestock that you own benefit the household?

_____

_____

Do you have access to agricultural land?

Yes ☐

No ☐

Do you perform any agricultural activities?

Yes ☐

No ☐

If you have access to agricultural land but do not perform agricultural activities, state the reasons for this?

_____

_____

If you perform agricultural activities, state what you do with your agricultural produce?

_____

_____

What items do you consider to be important assets in this household?

_____

_____

Assessing the households interactions with water

Do you pay for water?

Yes ☐

No ☐

If yes, what is the most and least amount of money you ever pay for water?

Most _____

Least _____

Where do you get your water from?

Community stand ☐ Borehole water or piped water? _____

Private stand inside the yard ☐

Private boreholes inside the yard ☐

Community stand & private Borehole ☐

Private stand and community stand ☐

Private borehole and Private stand ☐

Community water tanker ☐

If you receive water from more than one source, please state what your main source of water is?

_____

_____

Do you ever experience a disturbance in your main water supply?

Yes ☐

No ☐

Please elaborate on what the disturbance or disturbances your experience and how long they last?

_____

_____

At present, are you receiving water from your main supply?

Yes ☐

No ☐

If no, why are you not receiving water from your main supply?

_____

_____

How long have you not been receiving water from your main supply?

_____

_____

Have you ever experienced piped water cuts that last for less than a day?

Yes ☐

No ☐

Have you ever experienced piped water cuts that last for more than a day?

Yes ☐

No ☐

What is the longest time that you have experienced a piped water cut?

_____

_____

How often do piped water cuts occur?

_____

_____

Where do you get your water from when you experiencing piped water cuts?

_____

_____

What types of activities do you use piped water for?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

State what 'other' is (if applicable)

_____

_____

What types of activities did you use piped water for prior to any time before 2010?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

State what 'other' is (if applicable)

_____

_____

Why did you decide to stop participating in any of the activities that you no longer engage with?

Domestic: _____

Agriculture: _____

Livestock: _____

Gardening: _____

Small business: _____

Other: _____

Mention specific activities that you would participate in if you were not experiencing challenges in accessing water?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

State what 'other' is (if applicable)

_____

_____

How would the activities that you have mentioned improve the quality of life for you and your family?

_____

_____

_____

_____

Which of the activities that you would like to participate in were you participating in prior to 2010?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

Which of the activities that you would like to participate in were you participating in even during 2010 and beyond?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

State what 'other' is (if applicable)

_____

_____

_____

Do piped water cuts disturb any of the listed activities?

Domestic ☐

Agriculture ☐

Livestock ☐

Gardening ☐

Small business ☐

Other ☐

State what the small business is (if applicable)

_____

_____

State what 'other' is (if applicable)

_____

_____

State how the disturbance affects the listed activities?

Domestic: _____

Agriculture: _____

Livestock: _____

Gardening: _____

Small business: _____

Other: _____

Please rate your household capacity to withstand water scarcity in individual water-related activities.

	Water scarcity management capacity		
Activities affected by water scarcity	Good	Fair	Poor
Domestic use			
Agricultural use			
Livestock use			
Business use			

Please rate the level of importance of different water-related activities in your household.

	Level of importance or non-importance of water-related activities in sustaining rural livelihoods			
Activity	Not important	Important	Very important	Seasonal importance
Livestock farming				
Agricultural farming				
Business use				
Domestic use				

Additional information:

_____

_____

_____

_____

_____

Have you ever gone without water for any other reasons either than piped water cuts that are experienced by all/most households in the village? (Choose from the listed options)

Poor water quality ☐

Unable to pay for water ☐

Other ☐

Please state what 'other' is (if applicable)

_____

_____

Additional information

_____

_____

_____

How would improvements in the water supply benefit your household?

_____

_____

_____

_____

Does water scarcity affect the listed items?

Item	**Yes**	**No**	**Maybe**
General human welfare			
Household income			
Businesses			
Hygiene			
Food security			
Livestock investment			
Stress levels			
Domestic activities			
Other			

Additional information

_____

_____

_____

How does water scarcity affect the following?

General human welfare: _____

Household income: _____

Business: _____

Hygiene: _____

Food security: _____

Livestock investment: _____

Stress levels: __ _____

Domestic activities: _____

Other: _____

What are the reasons why you engage with listed water-related activities?

Domestic: _____

_____

Agriculture: _____

_____

Livestock: _____

_____

Gardening: _____

_____

Small business: _____

_____

Other: _____

_____

What do you think happens to water from Sehujwane dam?

_____

_____

What are your general opinions/concerns/points of satisfaction with regards to water supply in the village?

_____

_____

Would you say that current solutions to water shortages are working for you?

_____

_____

Are you happy with your primary water source?

Yes ☐

No ☐

Are you happy with your secondary water source?

Yes ☐

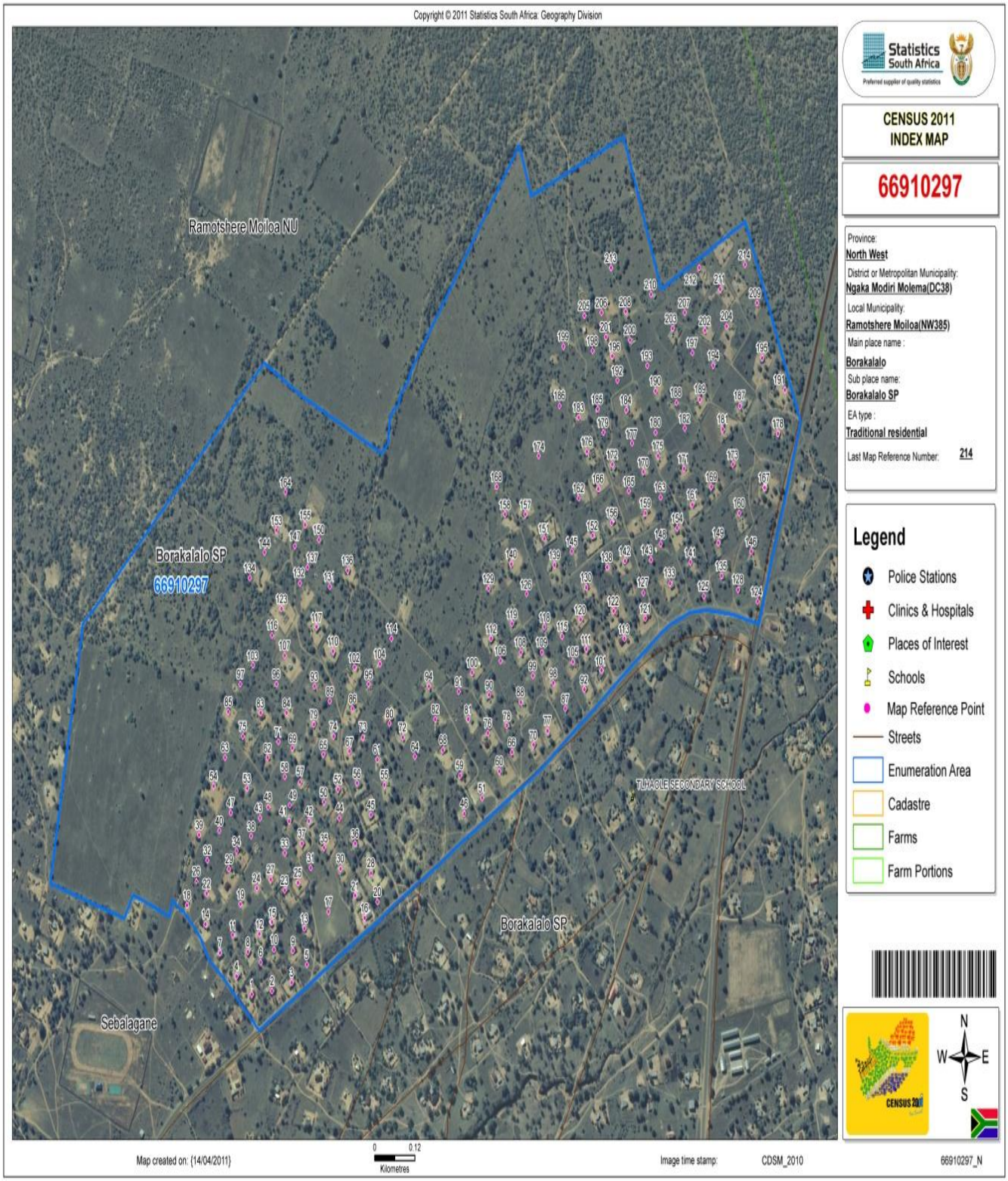
No ☐

Appendix 3

Maps of different sections of Borakalalo village

1) Census 2011 Index Map: 66910297 (Section A in figure 2)
2) Census 2011 Index Map: 66910296 (Section B in figure 2)
3) Census 2011 Index Map: 66910293 (Section C in figure 2)
4) Census 2011 Index Map: 66910294 (Section D in figure 2)
5) Census 2011 Index Map: 66910295 (Section E in figure 2)
6) Census 2011 Index Map: 66910238 (Section F in figure 2)
7) Census 2011 Index Map: 66910235 (Section G in figure 2)
8) Dwelling Frame Address and maintenance: Borakalalo

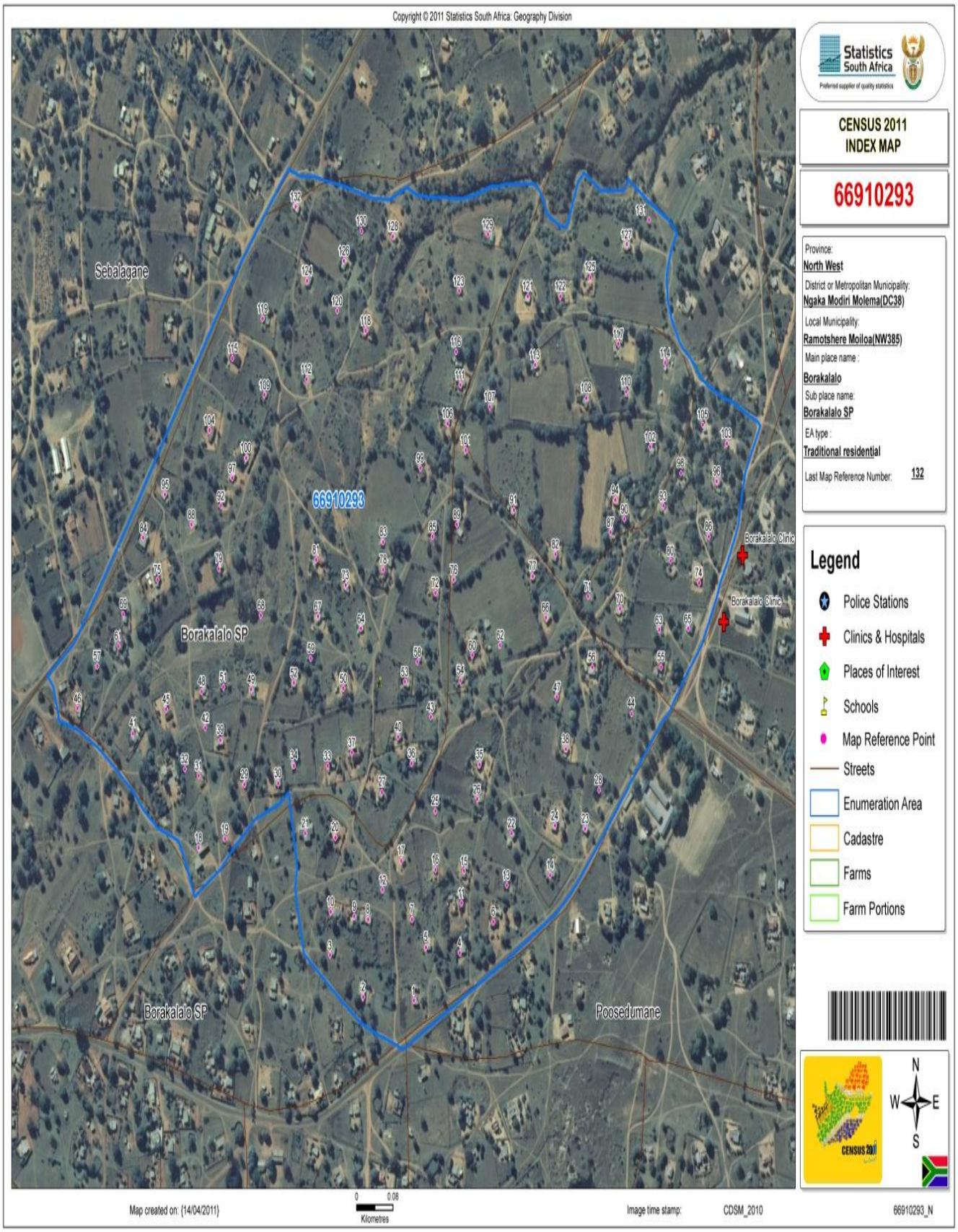
Map: 66910297 (Section A in figure 2)



Map: 66910296 (Section B in figure 2)



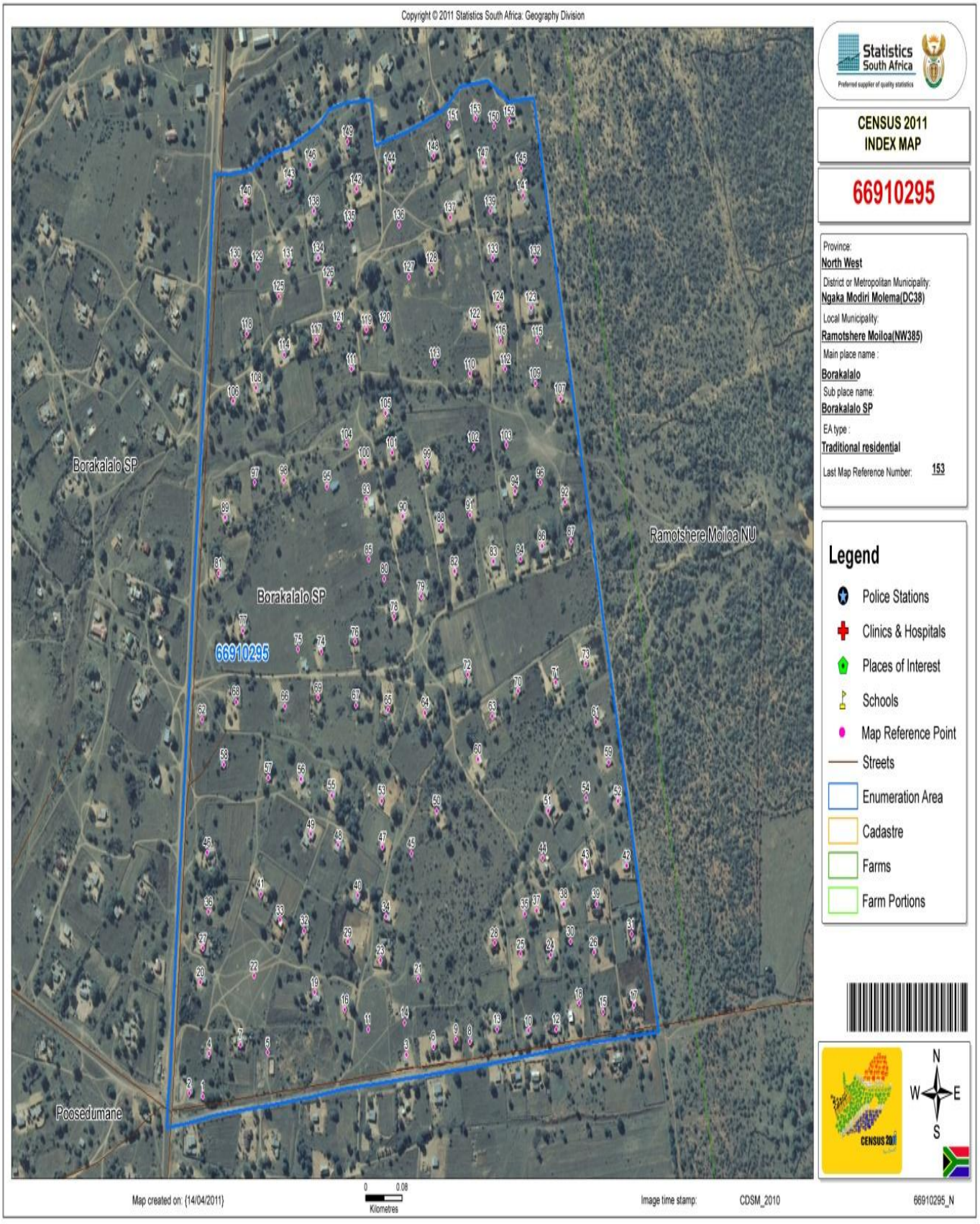
Map: 66910293 (Section C in figure 2)



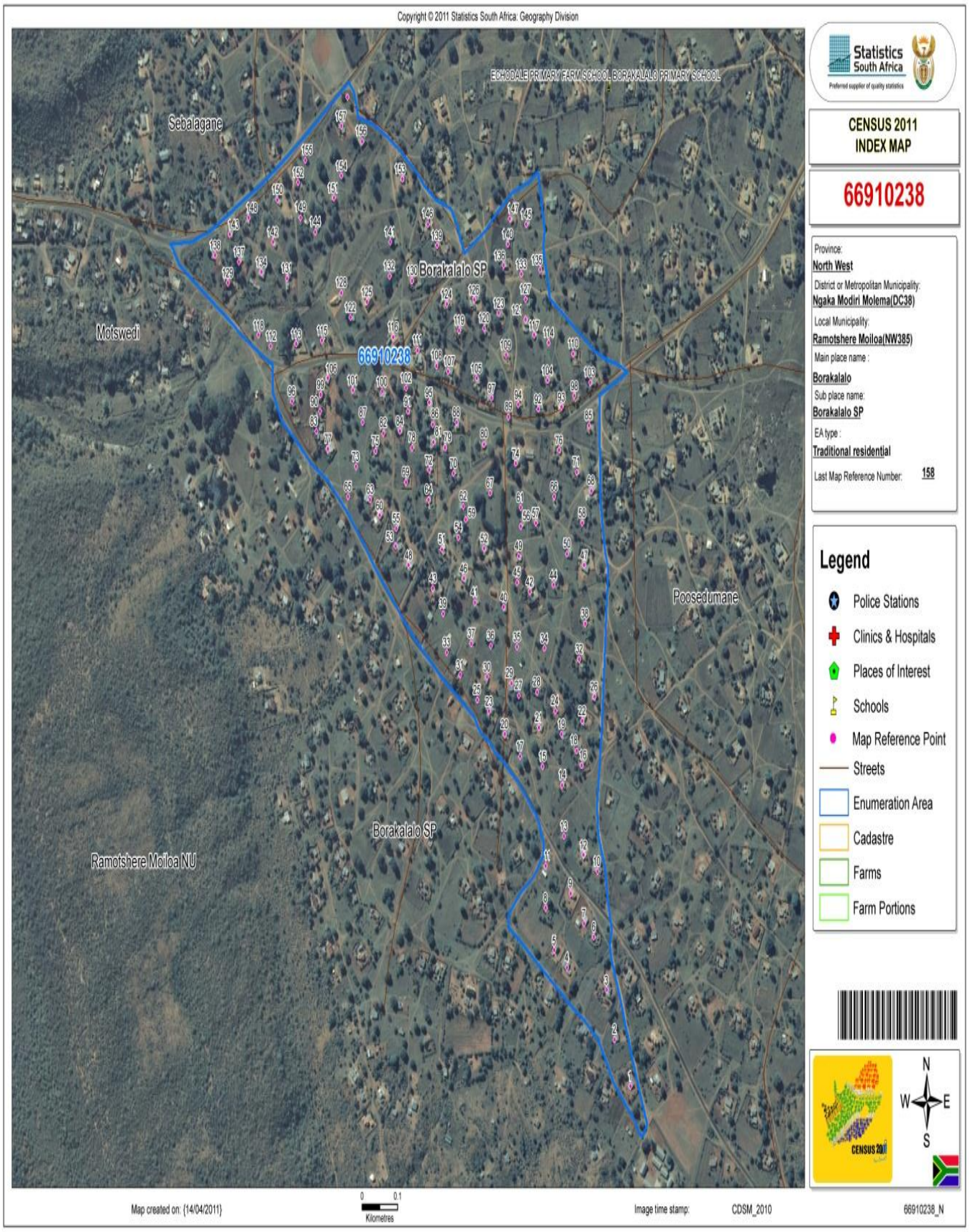
Map: 66910294 (Section D in figure 2)



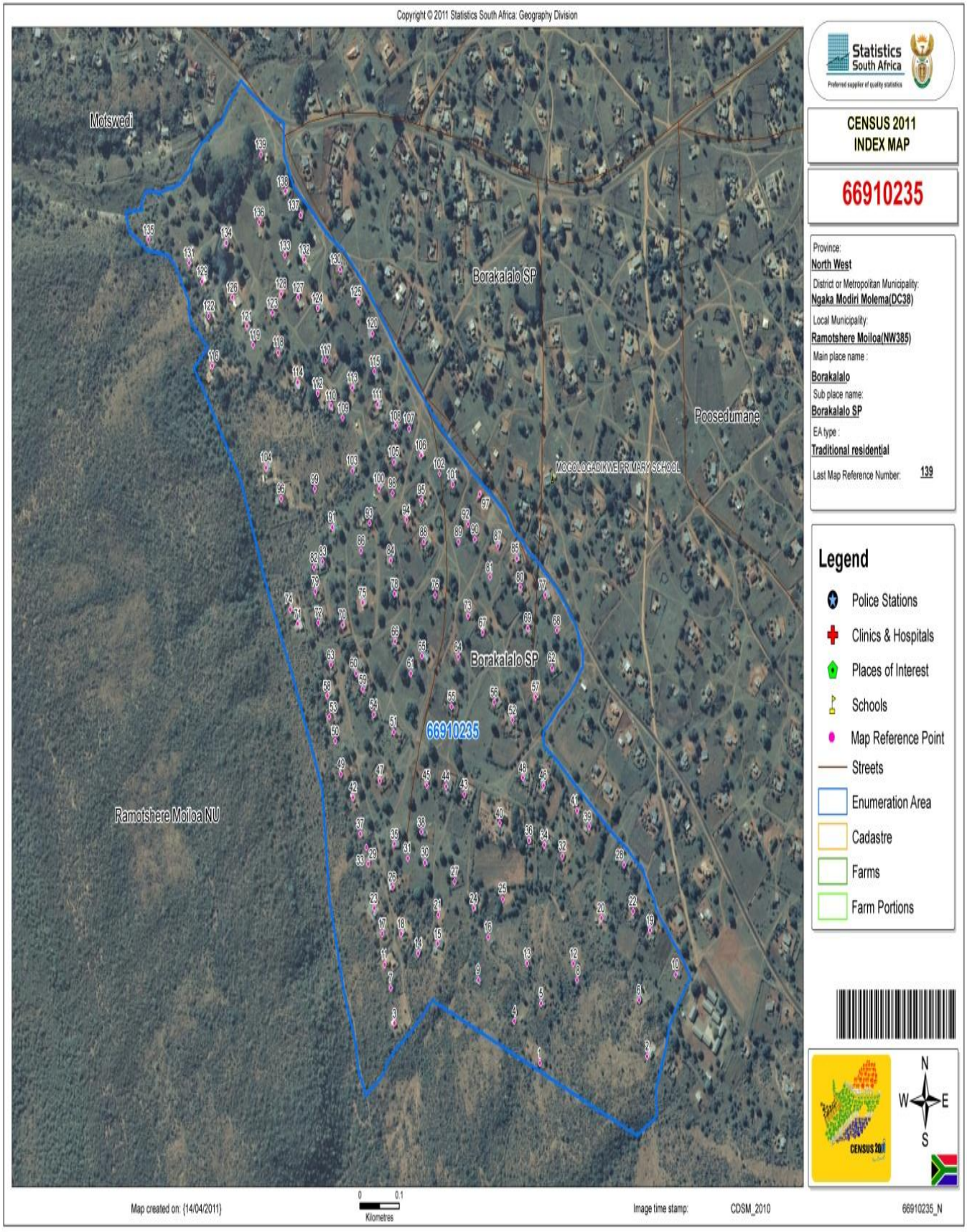
Map: 66910295 (Section E in figure 2)



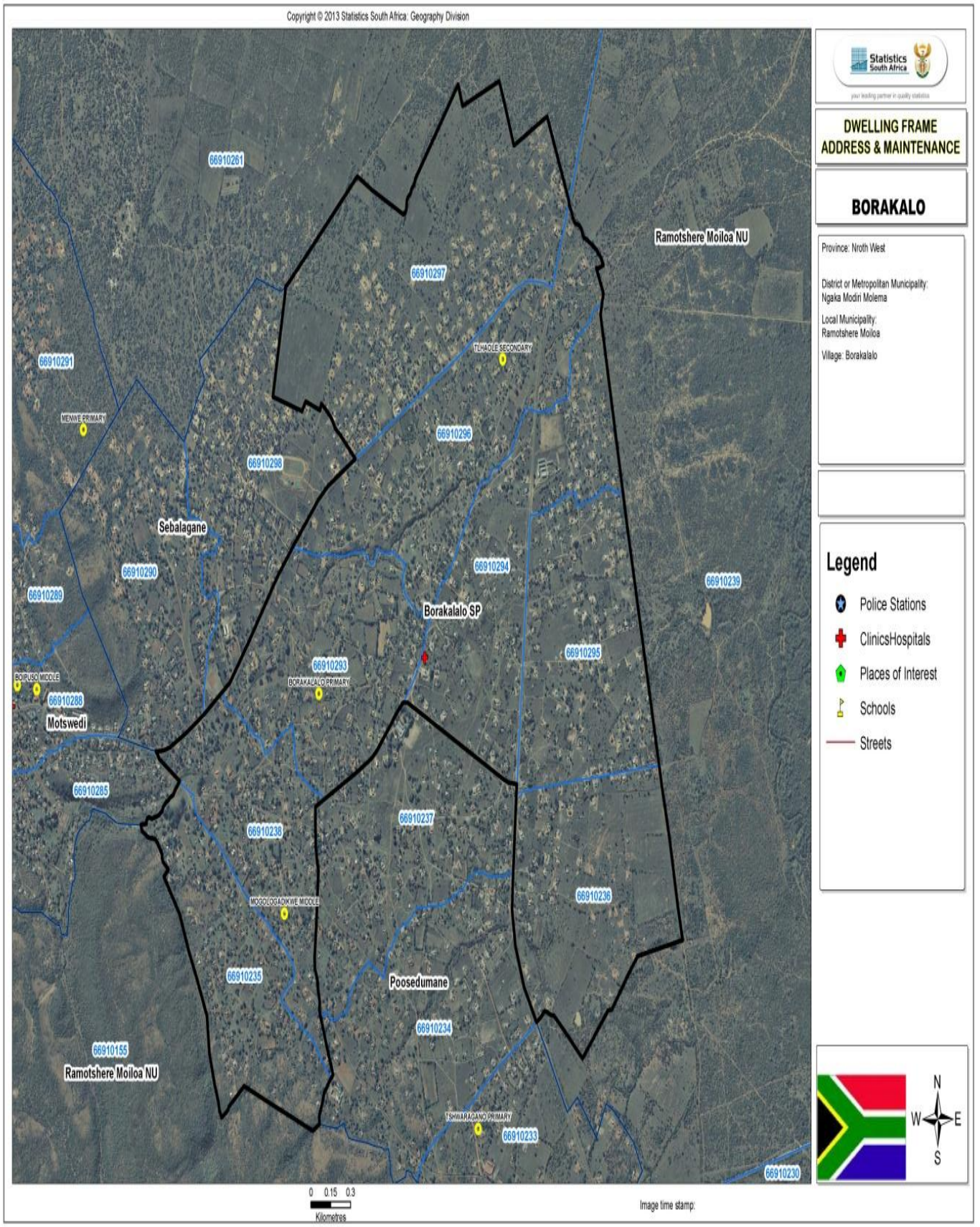
Map: 66910238 (Section F in figure 2)



Map: 66910235 (Section G in figure 2)



Dwelling Frame Address and maintenance: Borakalalo



Appendix 4

2011 Census data of Borakalalo village

1) Space-Time Research
   Census 2011 Release v1.1

   Table 1: Age in completed years by Sex

2) Space-Time Research
   Census 2011 Release v1.1

   Table 2: Grouped level of education by Sex

3) Space-Time Research
   Census 2011 Release v1.1

   Table 3: Official employment status by Sex

4) Space-Time Research
   Census 2011 Release v1.1

   Table 4: Summation Options for Borakalalo Village

5) Space-Time Research
   Census 2011 Release v1.1

   Table 5: Piped water for Borakalalo Village

Space-Time Research
Census 2011 Release v1.1

Table 1

Age in completed years by Sex

for Person adjusted, Borakalalo

	Male	Female	Total
0 – 4	557	600	1156
5 – 9	528	567	1096
10 - 14	546	502	1048
15 - 19	516	474	990
20 - 24	403	369	772
25 - 29	285	286	571
30 - 34	275	260	534
35 - 39	207	293	501
40 - 44	177	284	461
45 - 49	174	239	414
50 - 54	163	229	392
55 - 59	148	247	395
60 - 64	167	217	384
65 - 69	137	203	340
70 - 74	103	148	251
75 - 79	53	90	143
80 - 84	25	90	115
85 +	26	71	97
Total	4491	5168	9659

Space-Time Research
Census 2011 Release v1.1

Table 2

Grouped level of education by Sex

for Person adjusted, Borakalalo, 17 – Unspecified

	Male	Female	Total
No schooling	476	467	942
Some primary	406	556	962
Completed primary	152	183	336
Some secondary	870	999	1870
Grade 12/Std 10	587	854	1440
Higher	93	194	286
Other	-	-	-
Unspecified	13	12	25
Not applicable	47	16	63

Space-Time Research
Census 2011 Release v1.1

Table 3
Official employment status by Sex
for Person adjusted, Borakalalo

	Male	Female	Total
Employed	500	531	1030
Unemployed	519	483	1002
Not economically active	1498	1883	3381
Unemployment rate (%)	50.93%	47.63%	49.31%

Space-Time Research
Census 2011 Release v1.1

Table 4
Summation Options
for Borakalalo

Number of housheolods	2645
Number of persons	9659
Avergae number of persons per household	3.6523

Space-Time Research
Census 2011 Release v1.1

Table 5
Piped water
for Borakalalo, Housing adjusted

Piped (tap) water inside dwelling/institution	391
Piped (tap) water inside yard	1356
Piped (tap) water on community stand: distance less than 200m from dwelling/institution	586
Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	124
Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	84
Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	14
No access to piped (tap) water	82
Unspecified	7
Not applicable	-

Created on 25 June 2015

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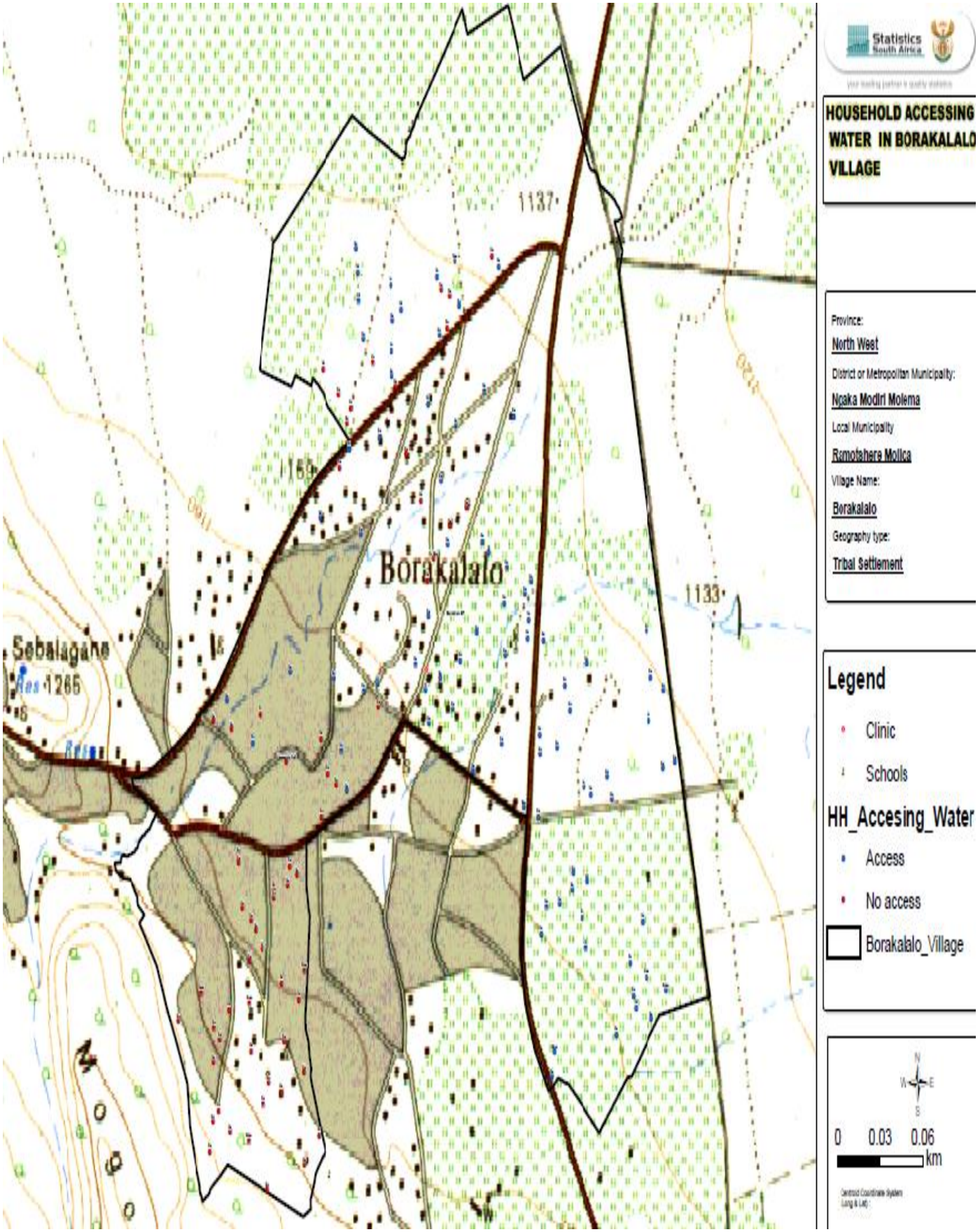
Appendix 5

1) Map illustrating access to running tap/piped water in Borakalalo village based data collected in this study (Statistics South Africa, 2015).


Statistics South Africa
HOUSEHOLD ACCESSING WATER IN BORAKALALO VILLAGE
Province:
North West
District or Metropolitan Municipality:
Ngaka Modiri Molema
Local Municipality
Ramotshere Molica
Village Name:
Borakalalo
Geography type:
Tribal Settlement
Legend
Clinic
Schools
HH_Accesing_Water
Access
No access
Borakalalo_Village
0 0.03 0.06
km
Borakalalo
Sebalagane
1137
1133
1265

Appendix 6

1) Ethics Clearance Certificate.

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Tabane

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H13/11/29**
PROJECT TITLE	The effects of water scarcity on rural livelihoods: A study of Borakalalo village in Lehurutse (North West Province)
INVESTIGATOR(S)	Ms L Tabane
SCHOOL/DEPARTMENT	GAES/
DATE CONSIDERED	25 April 2014
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	04 June 2016

DATE 05 June 2014 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Dr D Simatele

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES