

A Critical Evaluation of Urban Water Management: Comparative Case Studies of Meadowlands Township, Soweto and Florida Suburb, Roodepoort

by

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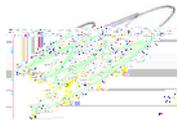
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ABSTRACT

Water is a vital component for human survival but unsustainable patterns of water consumption are still evident internationally. In South Africa, water conservation has traditionally been limited to the responsibility of the state, with little effort being made by the consumers. However, as water scarcity increasingly becomes a problem, government and residents need to find out how urban South Africans can access water and implement water conservation methods in their homes without the support of government supervision programmes. This study explores the relationship between urban residences in two different parts of Johannesburg (Meadowlands in Soweto and Florida in Roodepoort) and their consumption, perception and usage of water and its conservation. Based on interviews with residents from different backgrounds, the results of this research show that residents have varied but generally limited concern for water issues.

Findings from this study indicate that for a resident to conserve water, the type of abode in which he/she lives is irrelevant. Whether the resident lives in suburban home or small government funded housing, the attitudes of the interviewees and the perceptions which they expressed regarding solutions to the water dilemma proved to be similar: people in these urban areas are aware of the importance of water conservation, however, there is limited practice thereof.

Key terms:

Water conservation, Households, Perceptions, Meadowlands, Florida, Access, Residents, Sustainability, Income, Community, Climate Change, Comparison

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Chapter One

Introduction

1.1 Introduction

Recent research in water management reveals that water conservation is understood differently by communities in various regions and countries (Gilg and Barr, 2006; Muller, 2008; Fan *et al*, 2013; Nnadozie, 2013; Kossieris *et al*, 2014). Water research scholars in particular have for some time been interested in the question as to whether urban residents practise water conservation on their premises (Thompson *et al*, 2000). The multi-dimensional nature of the concept of water conservation could create difficulties in the formulation of water conservation policies and also in the implementation of appropriate measures, especially at community level (Bakker, 2013). It is thus important to analyse the behaviour of communities in respect of the conservation of water and the tendency to focus on various environmental aspects, including the use of water in the urban and rural context (Behailu *et al*, 2015).

South African communities often lack knowledge on water conservation (Nnadozie, 2013), mostly relying on government institutions to undertake the purification and distribution services to make water available and to ensure that it is safe for consumption. This then becomes a challenge in terms of ensuring the sustainability of water, as the main users do not currently have adequate skills for managing their potential roles and responsibilities regarding water management (Tumbare, 2015).

Although a number of academics have written discursively on the nature of water conservation in urban areas, most of that research has been largely at a theoretical level (Syme *et al*, 2000; Smith and Hanson, 2003; Verdugo and Armenta, 2006; Sherwill *et al*, 2007; Randhawa and Marshall, 2014). This is a matter for concern considering that different social groups perceive and experience water usage and conservation in different ways depending on the specific circumstances in which they find themselves (Coleman, 2009).

Where the subject has been investigated in greater depth, the studies have focused mainly on Western countries and little attention has been given to the global South (Kucher, 2005). Water conservation is a challenge especially

because it involves different dynamics of life, driven by the social and political arenas (Spronk, 2010).

The South African case is especially interesting, given South Africa's history of colonial occupation, dispossession and racial discrimination. The history of service delivery in South Africa has been biased, since during the Apartheid era, the areas set aside as the black South African townships had little access to clean water (Nnadozie, 2013). It is at this point that we can refer to the delimitation of Soweto as an area for black people. It was denied the delivery of municipal services such as water (Richards *et al*, 2006).

Following the end of Apartheid in 1994, the national government sought to address water service inequalities by formulating the New National Water Act 36 of 1998 of South Africa (RSA) to ensure equitable access to water (van Tonder, 1999). As Bawa (2011) noted, a major challenge for the South African government has been to provide all South Africans with water to satisfy the growing demand for this vital resource.

The different forms of human settlement in South Africa and the peculiarities of each case need to be carefully recognised and understood when projects for water provision are researched (Bakker, 2013). Race, social class and income levels are often reflected in the type of settlements in which people live and in their methods of accessing and using water.

All of these factors vary. To name but a few examples: some access water from inside household taps via pipes from municipal reservoirs, while others gain access to water by fetching it in buckets and wheelbarrows from rivers and lakes. In urban informal settlement, people often access water from higher-class neighbouring community (Nnadozie, 2013).

Income level has been found to play a vital role in basic service delivery. Those who have the money can afford to buy water from private companies while those who are members of the financially disadvantaged class rely on government to supply their demand for water by taking water from rivers or water bodies accessible to them (Roy *et al*, 2013). During the Apartheid era, informal settlements did not have access to water services from municipalities as the settlements were informal and therefore illegal since they did not comply with the municipal regulations for township development (Kucther, 2005). The only communities that were able to pay for water services were those in the white suburbs, especially in those areas which could access water legitimately.

Water is very crucial for humans regardless of the form, level of development of and service delivery to the settlement in which they live as a community. Irrespective of their income level and standard of living, all humans need to maintain particular household functions, such as having access to drinking water, and water for cooking, cleaning, bathing and gardening purposes. It is for this reason that informal settlements often feel themselves forced to access water illegally from formal settlement neighbourhoods (Nnadozie, 2013).

This study aims to compare people living in formal housing units in Florida (an established suburb in Roodepoort), with those historically underprivileged residents of Meadowlands township in Soweto, also on the West Rand. A comparison is made of their respective behaviours in terms of their consumption and conservation of water, and of possible ways to improve the sustainable use of water in each community, taking the differences in their respective social and economic classes into consideration.

There is an association between the average educational level of a community and the knowledge that its members generally hold with regard to water conservation, which in turn influences their behaviour in respect of water (Oyama *et al*, 2012). In this proposed study, the perspectives regarding water conservation of people living in a formalised urban environment, as in the case of Florida, are compared to those of residents living in an informal settlement, as in the case of Meadowlands.

The significance of this research lies in the fact that this is one of the few studies to investigate the social framework of water in a South African context. This research is presented over several chapters. Chapter one contains the introduction, problem statement, aim and objectives of the research. Chapter two contains the literature review, where different ideas and research performed in different countries on water issues is explored. Chapter three describes the research methodology and procedures that were followed to execute the research. Chapter four analyses the results that were found from interviewing the respondents on water matters. Chapter five covers discussion, linking findings from the literature review with the data analysis and combining it together to assess in detail the perspectives of water conservation set out in the aims and objectives. Chapter six concludes this thesis by summarising this study and putting forward recommendations for future research. Note that the data analysis and discussion are separate chapters. Note that Chapter Four (data analysis) analyses the responses of residents from Meadowlands and Florida with water,

after which Chapter five elaborates and discusses the details and key findings of the data analysis separately.

1.2 Problem statement

Empirical research that explores discursive articles on the nature of water consumption and conservation are largely limited to South African urban settlement (Oyama *et al*, 2012; Pähle, 2013;). This study seeks to add to the growing body of literature that analyses the uncertainties in water supply and conservation, as well as the gradual and eventually abrupt change in water availability in the urban household context of South Africa as a developing country (Pähle, 2013).

Few academic studies have focused on comparing different households in terms of the behaviour of their residents with regard to accessing water, their consumption of it and the manner in which they conserve it. These studies have approached the subject from the perspective of how households and the income levels of the residents influence access to water and the conservation measures used, and demonstrate how the above factors influence and regulate water consumption (Crawford and Bell, 2012; Sadalla *et al*, 2014).

1.2.1 Aim

The aim of this study will be to:

- critically compare and evaluate the methods of water conservation and understanding of water usage as perceived by residents of distinct socio-economic groups.

1.2.2 Objectives

To achieve the aim above, the following objectives have been put forward:

- To critically evaluate and compare the value that households belonging to distinct socio-economic groups attach to water;
- To explore methods used by both informal settlements and formal settlements respectively to access water and to undertake an analysis of actions that residents have taken in order to conserve their water supply and to make it sustainable;
- To assess and compare the impact of water usage on water conservation practices in the case of lower and higher income households;

- To examine the challenges faced by residents of the study areas in terms of their consumption of water and conservation;

1.2.3 Research Questions Study

This proposed study project aims to answer the following key question and the subsequent subordinate questions:

1.2.4 Key question

How does social economic class affect the way formal and informal residents perceive and conserve their water?

1.2.5 Subordinate questions

1. What critical evaluations do households in formal and informal settlements (living under different socio-economic conditions) attach to water?
2. What are the methods used by the residents of formal and informal settlements to access and conserve water?
3. What actions are residents taking in order to conserve their water supply and to make it sustainable?
4. What are the different practices for using and conserving water that are being conducted in formal and informal settlements in terms of the different socio-economic levels of the respective households?
5. What are the challenges faced by residents in terms of the consumption of water and conservation practices?

The main question concerns water conservation in two different urban residential areas in Gauteng, South Africa, and it touches on the key aspect of people's well-being and their means of earning a livelihood. Access to water for consumption at the household level is pivotal in terms of people's health, their standard of living, and their daily lives in general (Pähle, 2013). In order to contextualise and add value to an understanding of water conservation, it is also necessary to understand related factors, such as access to water sources, the cost of water, consumption patterns, and potential strategies, as well as those strategies already in place that people could implement and are already implementing to increase the sustainability of their water usage. The above-mentioned questions have been designed to address these aspects in order to identify and evaluate the different possibilities and strategies communities could apply in respect of conserving water as a valuable resource.

The significance of this study is to make a contribution to better understanding the community perceptions and practice of water consumption and conservation within different income groups. This issue was researched by evaluating and addressing their perceptions of the challenges facing their households with regards to water consumption and conservation, and their concomitant behaviour in this respect. The communities of Meadowlands and Florida could make certain recommendations on water usage in the context of the consumers of water themselves.

Chapter Two

Literature Review

2.1 Introduction

There is an increasing volume of literature on water conservation from a socio-scientific perspective (Domene and Sauri, 2006; Tom *et al*, 2011; Macfarlane, 2013; Waller and Scott, 2013). Much work of this nature focuses on water science purification programmes undertaken by private water companies. Across the planet, the demand for water is increasing because of rapid population growth, economic development and life-style changes. These dynamics have generated raised rates of water consumption (Gilg and Barr, 2006).

Bakker (2013) highlighted that water plays a vital role in sustaining humans and the organisms on which they rely for their food supply, in fostering socio-economic development and in maintaining ecosystem health. It also focuses on the fact that water management has become a global problem and those methods of effectively achieving this are being hotly debated by international states. Recent research reports that various water conservation policies have been adopted by different countries who try to force communities to apply these measures in their daily lives (Clark and Finley, 2007a; Tom *et al* 2011; Bakker, 2013).

Under the prevailing conditions of climate change and population growth, water conservation is proving to be a serious issue. This is a challenge around the world, particularly in the urban areas to which large numbers of people are migrating (Toteng, 2008). Water is a crucial resource, vital to human life, and the lack of it, along with its various impurities and diseases, is one of the main environmental problems that decision-makers are facing in the 21st century. Communities throughout the world are suffering from water shortages and have limited access to drinkable water (Bakker, 2013; Waller and Scott, 2013).

Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere and to meet the current and future human demand for water. Population, household size, growth and affluence all affect how much water is used (Smith and Hanson, 2003). Education, water meters, technology, water-conserving home appliances such as washing machines, lawn(grass) and regulations for garden watering are examples of effective water conservation

practices (Macfarlane, 2013; Kossieris et al, 2014). The role of the education could be where communities get some free access on learning about water conservation and the important of water.

This chapter incorporates a sample of relevant literature from various schools of thought on water conservation. It provides a lens through which the notion of water conservation can be implemented and understood across the planet. Water conservation means storing water surpluses when there is plenty, eliminating any waste and protecting the quality of the water (Lotti, 1992).

Researchers such as Birch and MacLock (2013) believe that conservation is about the wise use of water over time. This chapter compares different countries (developed, developing and South Africa) in terms of water supply and water conservation and examines the relevant strategies that are being adopted in these respects (Xiong *et al*, 2016). It also relates how all of these countries deal with water, with particular reference to South Africa.

2.2 Water in developed countries

2.2.1 Canada

Canada is one of the most developed countries in the world in terms of sustainable development and resource use. Throughout the Canadian communities, water supply is part of economic development along with waterconservation. According to Lotti (1992), water is a vital part of development and reflects progress in countries such as Canada. Researchers such as Walter and Scott (2013) found various methods in Canadian municipalities that involve community involvement to deal with water conservation and consumption. The municipalities in Canada have set up water conservation initiatives in sixty- three of the sixty four municipalities, with the following initiatives:

- To raise awareness of water as a resource
- To defer the capital costs of water treatment,
- To show concern for the environment,
- To avoid the necessity of meeting the demand for a new water supply and of supplementing the water supplies of reservoirs in the country.

Some of the practical methods used in Canada by municipalities to implement projects to supply each household with water, to augment the supplies of water to water authorities, and to encourage households, water authorities and stakeholders to work together to promote water conservation (Walker and Smith 1998). This is the way of method whereby water supply centralises water provision and be responsible to water conservation.

Waller and Scott (2013) examined the local collaborating groups of different social backgrounds in Canadian communities and the role they play in promoting water conservation. The collaborating groups include local economic development groups, the local Chamber of Commerce in each community and community environmental groups and their programmes. Their main role is to monitoring water use around the community and teach the community about the important of water.

Metering in Canada is a must for communities that want to reduce their water consumption. Without a user-pay system, water will continue to be wasted. In communities where metering was introduced as part of a water conservation initiative, reduction in consumption was effected once the metering had been implemented (Domene and Sauri, 2006).

The promotion of water conservation is considered crucial in a successful water management programme. Public awareness about resources potentially threatened with depletion has increased in those communities which advertised and promoted water conservation (Xiong *et al*, 2016). Based on the success of the water programmes in Canada, many communities agree that without public awareness and assistance from the authorities, water conservation cannot be accomplished.

2.2.2 United States of America

The United States of America (USA) has encountered a variety of challenges concerning water conservation. The demand for water in California is increasing, whereas the availability of water is declining (Tom *et al*, 2011; Waller and Scott, 2013). After continuous droughts in 2009 in the state, as well as the growth in the population numbers experienced, water conservation has been considered to be the best option to be deployed in California (Tom *et al*, 2011).

Californian Regulation AB 2572 mandates the installation of water meters in single-family homes built in or after 2005 and the retrofitting of water meters by 2015 for older homes where the flat rate previously applied (Tom *et al*, 2011;

Waller and Scott, 2013; Woltemade and Fuelhart, 2013). The placing of water meters in households that did not previously provide feedback on their water consumption will now make it possible for these households to receive this information with their water accounts.

Werner *et al*, (2015) and Tom *et al*, (2011) agree that the strategies applied by California to directly link the billing amount to the volume of water usage provides a financial incentive to conserve water. Other relevant measures that can be quoted include those imposed by the Sacramento City Council for violations of water conservation rules, as follows (Werner *et al*, 2015):

- Limiting landscape irrigation to three days per week on the basis of odd or even numbers for the street addresses.
- Limiting landscape irrigation to only one day per week during winter.
- Banning irrigation on permitted watering days between 10 a.m. and 6 p.m.
- Allowing cars to be washed only on permitted watering days.
- Forbidding car washing without a shutoff nozzle attached to the hose, with the imposition of fines, thus underscoring the importance of water conservation.
- A first violation results in a warning notice; a second incurs a \$25 fine unless the perpetrator undergoes appropriate educational instruction, a third amounts to \$100 and subsequent violations amount to \$500 each (Tom *et al*, 2011).

In all, the actions of the state and the city reflect the importance that they place on water conservation. This they do through implementing innovation programmes such as public education, rebates, technology, smart sprinklers, water-wise landscapes and water pricing (Waller and Scott, 2013).

Public policy may offer agendas for improving water conservation, while public relations and advertising campaigns may increase awareness. The city believes that such efforts may result in changes in the attitude of the public.

Burgin and Webb (2011) argue that the effectiveness of water conservation rests with compliance at the level of the consumer or household. In the case of individuals in households, this means that not only must they be aware of the need for water conservation, they must also identify the behavioural changes necessary to conserve water usage. The creation of effective water conservation programmes must not only target specific water conservation behaviours but

also provide informative meaningful feedback resulting from behavioural changes (Gilbertson *et al*, 2011; Tom *et al*, 2011,).

According to Xiong *et al* (2016), effective water conservation programmes in California would first need to provide a baseline of water usage that identifies not only the global volume of water usage, but also the source of household water usage such as in the case of garden irrigation, the kitchen, bathroom, laundry and other domestic water utilities. Their findings indicate that households would need feedback on water usage as a result of their change in attitude and their behaviour in respect of water usage and conservation. These aspects could also give the water authorities direction in improving water strategies that are convenient to the residents.

The potential reduction in the demand by residences for water was estimated by multiplying the projected conservation for each programme, such as the toilet and washing machine rebates, with the home water audits (; Tom *et al*, 2011; Waller and Scott, 2013). The age of the house and improved technologies for determining rebates was considered as the main motivations for encouraging indoor water conservation. According to Pennsylvania regulations (Woltemade and Fuellhart, 2013), conservation via toilet and washing machine retrofits was considered to bring about gross and net water savings. Gross conservation is useful for predicting the total demand for water in the future, whereas net conservation is appropriate when examining the cost-effectiveness of conservation programmes.

The impact of conservation programmes on waste water flows is estimated by subtracting all of the water savings associated with replacement toilets and washing machines from households (Tom *et al*, 2011). Indoor and outdoor water leaks in Pennsylvania households are identified as the cause of main water waste during the audits. In fact, a greater number of indoor water leak repairs would lead to reduced water flow but greater consumption. Repairs to leaks in indoor pipes, taps would lead to greater water flow and less wastage but to increase water usage indoors. As a result, the vast majority of Pennsylvania residents apply water conservation measures by repairing mainly the leaks indoors (Woltemade and Fuellhart, 2013). As such, it was found that indoor water leak repairs as opposed to outdoor water leak repairs form the major part of water conservation in this state.

2.2.3 Australia on water supply and management

Since the early settlement of Europeans in Australia, collective water supply structures have been moulded on the European model, and the administrative arrangement of water resource management has not changed over time (Birch and MackLock, 2013). Australia is one of the most highly urbanised countries in the world, and the driest inhabited continent (Werner and Davidson, 2015).

The Metropolitan Water Plan for Sydney is a system that was introduced to manage the supply of and demand for water around a city habitat (Bawa, 2011). Pumps have been installed to reach great depths in major dams. Furthermore, a desalination plant has been commissioned to increase the supply of fresh water (Birch and MackLock, 2013).

With the unceasing worldwide increase in population and increased densities of people in the urban areas, together with the lower rainfall across extensive parts of Australia - on account of climate change - water conservation programmes have become a major sphere of interest and activity for communities and water authorities (Bawa, 2011; Birch and MackLock, 2013). As such, a strengthening of the approach to wise water use in urban areas is what is now required.

One of the strategies employed by the Australian government was to use the Sydney Water Corporation (SWC) to support water conservation. This institution subsidised the introduction of water-wise fittings, such as retrofit appliances (toilets dams, showerheads, faucet aerators and washers), in households, and the installation of water tanks complying to specific parameters to meet with the financial allocations per suburb (Waller and Scott, 2013). The above water conservation measures are crucial especial in urban areas where water is regulate by municipality by assisting citizens to minimise water use. Such action can limit the water use as an mutual benefit both households and water provider.

Along with seeking additional sources of water, there have also been major advertising campaigns to reduce the consumption of water, as in the case of the Sydney Water Corporation's campaign to "go slow on the H₂O" (Werner and Davidson, 2015). Over and above that, water restrictions have been imposed on outdoor use and to the extreme, the amount of water that can be used by an individual resident has been limited. The need for change in the volume of

consumption and in water usage consumption patterns has been addressed by imposing fines for breaking the water restriction rules (Werner and Davidson, 2015).

It is challenging to change the culture of water usage comparing to change the temporary behaviour of a community during times of water crisis such as droughts. These sometimes makes water restrictions requires a new approach to the implementation of policy (Birch and MacLock, 2013; Woltemade and Fuellhart, 2013). Community education initiatives were seen as a means to build awareness and to change the attitudes of the residents. Together with engaging people practically in water conservation at the household level, this would be more effective (, Waller and Scott, 2013; Birch and MacLock, 2013; Xiong *et al*, 2016). Based on community engagement that was considered in Australia as part of an endeavour to conserve water, most residents mentioned that rain water tanks could be useful as measures to support their water conservation programmes around the country (Woltemade and Fuellhart, 2013).

Rain water captured on site is used to supplement the household water supply, especially in the case of the outdoor uses (the garden and swimming pool) and indoor uses the toilet and geyser; (Gilbertson *et al*, 2011). Water tanks were seen to have an impact on the material supply of new water for household uses and on the attitudes of the community to water and water use (; Ying *et al*, 2013; Fan *et al*, 2013; Amery, 2009; Betanzos *et al*, 2016). Rainwater tanks provide an avenue for the local water supply to be under the ownership and control of the household. However, in winter, when there is a shortage of rainfall, the water tanks are not used. This means that they are productive mainly in the summer rainy season.

Some Australian communities prefer to use water tanks for outdoor usage such as watering gardens, hosing pathways and cleaning the car (Cockerill *et al*, 2015). Garcia, *et al* (2013) believes that water tanks are becoming key conservation measures in seasonal rainfall areas. Water tanks are useful in rural areas for conserving water as the only alternative to have access to and to store water for future use. To support the Australian urban suburban lifestyle in particular, the authors note that the Australians rely more on the water authorities

in their country to gain access to water (; Fuellhart, 2013; Garcia *et al*, 2013; Gilbertson *et al*, 2011).

Some Australian experts are of the opinion that the point of end use of water should be metred from the point of capture since the conservation of water through water meters has greater benefits than the mere conservation of reticulated water (Birch and MacLock, 2013; Woltemade and Fuellhart, 2013). They believe that water meters independently inspire the user to become more aware of the problems issuing from water scarcity and the benefits of conservation. The water meter presents a concept on which to motivate the social change required to support the conservation of water Darwin, a town in Australia, has built dams and tanks as traditional structures to increase its water capacity and to help manage a tenfold growth in demand since 1950 (Garcia *et al*, 2013). The Darwin City Council implemented water conservation measures, the use of household rainwater tanks, the re-use of household grey water and large- scale water recycling projects (Garcia *et al*, 2013). It also reinforced calls for alternative water supply options to be considered in environmental management plans (Birch and MacLock, 2013; Garcia *et al*, 2013). The aim of its environmental management plans was to develop and implement a 20 year water sustainability programme to intensify water conservation practices in communities, NGOs and water authorities. The plans were also in place to investigate alternatives for supplying water and to promote the use of efficient devices and appliances amongst consumers. In spite of this initiative, Darwin still has the highest per capita water consumption for any capital city in Australia (Garcia *et al*, 2013). To promote water conservation within the city, water conservation campaigns were set in place to educate the residents/consumers by means of, amongst others, a brochure entitled *The Green Guide* (Garcia *et al*, 2013). This is a voluntary advocacy document convincing consumers to introduce water conservation measures for the sake of the environment. Examples suggested for the sustainable development of the water resources include the installation of water-efficient devices and appliances, the use of short showers, only washing when the machines are full, and limiting the outdoor use of water (Garcia *et al*, 2013).

2.2.4 Europe

The European Commission has recognized the classification of water conservation measures indoors as a means of encouraging consumers to opt for water-efficient products and practices (Kelly, 2015). Bakker (2013) highlighted

the challenges of the escalating demand on water supplies owing to population increase, economic growth and lifestyle changes which impact on water consumption (Kucher, 2005). Water availability is recognised as a major global issue for both the rich and the poor. Water conservation initiatives in Europe have been supported by the European Union (EU), which has been addressing the challenges in ensuring adequate water supplies to the European community (Burgin and Webb, 2010).

Water is a precious resource that requires considerable inputs in terms of chemical and technological filtering to purify it sufficiently for water consumption. Some developed countries of the world do not regard this as an insurmountable(impossible) problem, and countries such as Germany and Spain are making great strides in this respect of using chemicals in purifying water. Research has shown that water management in developed urbanised countries is improving as opposed to this component in developing countries (Beall and Fox, 2009).

The water meter box is one of the methods used to control the exploitation of a limited water supply (Zietlow *et al*, 2016). Researchers and technicians are continually trying to develop additional methods and to improve upon the existing solutions to satisfy the demand for water by an increasing number of people (Biagi and Ferro, 2011).

The European Commission has explored different strategies to face these challenges by evaluating issues such as the water-saving potential of the European community, the current policies and the efficiency standards for water-using devices in Europe, as well as water conservation in buildings within the member states (Inman and Jeffrey, 2007). Most European countries access their public water supply for consumption within their buildings. It much easy for countries that supply free tanks to communities to able to save rain water as part of methods run by government in water conservation to meet households halfway. Therefore, water conservation measures have been implemented to reduce indoor water consumption e.g. imposing water restrictions, introducing weighted pricing structures, water metering, staging information campaigns and promoting the installation of water-efficient products (Iiha *et al*, 2009).

Researchers in Europe found that by replacing inefficient water-related appliances with water-efficient alternatives, significant water savings could be achieved. Studies done by scholars determined that the replacement of all

standard household water-using products with highly efficient alternatives can reduce water consumption by between 37% and 50% per household (Inman and Jeffrey 2007; Waller and Scott, 2013; Kossierris *et al* 2014; Werner and Davidson 2015) . The study conducted in the United Kingdom indicates that shower head and toilet replacement programmes reported water savings of up to 40 litres and 145 litres respectively (Iliha *et al*, 2009).

Clark and Finley (2008b), considered water consumption and the adoption of water conservation behaviours by focusing on an important aspect, namely to encourage reflection amongst the interviewees as to their perceptions on firstly, the level of seriousness and the significance of drought and secondly, the certainty that conservation measures in water should be practised long term.

There was uncertainty among the scholars in assessing the situation of water conservation in Bulgaria, reported in a second article by Clark and Finley (2007a). The main issue in this case was the question as to what the focal point of water conservation was (i.e. the main motivation behind water conservation) (Clark and Finley 2007a).

In both of these reports by Clark and Finley (2007a and 2008b), the water authorities were looking at the seriousness of the water shortages in the community. The main issues that the authors raised were to determine how much water could be saved by engaging in conservation practices and to confirm the perception that conservation measures are equitable (Clark and Finley 2007a; Clark and Finley 2008b).

Based on their research findings Clark and Finley (2007a) could confidently state that socio-demographic factors play a huge role in the perspectives of the interviewees concerning the conservation of water in Bulgaria. The most common of these factors were found to be age, education, income and gender which all determine the rate at which and the ways in which water is used and conserved. These socio-demographic variables are interrelated to variable degrees and in accordance with the more essential value orientations of the interviewees. This was also the case with the younger generation in their learning about water conservation methods as part of their school and university education and their perspectives about the environment, droughts and water as a valuable resource (Xiong *at el*, 2016).

However, income appears to affect people differently in terms of their access to water and the prices that they pay for water. With the new water meter

installations and innovation retrofits, household issues such as toilet low flush (TLF) have helped communities to conserve water (Inman and Jeffrey, 2007; Kossieris *et al*, 2014). Some household end-user techniques (such as water meter) assist consumers to monitor and control on a real-time basis the water consumption of their household which provides valuable information and feedback to limit the day water use.

Households conserve water for various reasons, such as high prices and environmental awareness campaigns about water and drought (Massoud *et al*, 2013). Water conservation practices that are used in Barcelona by households include water-saving devices in taps, toilets and showers, advice to turn off running water while brushing the teeth, the purchase of water-efficient appliances and consultations concerning comparisons of water consumption over specific periods (Domene and Sauri, 2006; MacFarlane, 2013; Waller and Scott, 2013).

The price of water and household income are the main factors that determine the way in which people use water (Domene and Sauri, 2006). Water in urbanized areas is used for both indoor and outdoor purposes. Whether there are areas such as gardens and swimming pools will determine the amount of water used. In fact, researchers have found that the seasonal factor plays a huge role in water consumption outdoors (Domene and Sauri, 2006).

Indoor water usage and conservation vary in terms of the socio-economic level of the household/community. Researchers argue that variations in internal water consumption often depend on household size, for instance (Domene and Sauri, 2006; Gill *et al*, 2009; Crawford and Bell, 2012; Birch and MackLock, 2013; Macfarlane, 2013; Waller and Scott, 2013). Household size regulates the number of people and technological appliances that are used (e.g. washing machines and shower heads; Kossieris *et al*, 2014). Residential domestic appliances are used mainly in developed countries, which are also more likely to re-use and recycle water as part of their water conservation programmes (Domene and Sauri, 2006).

2.3 The Global South

The source of water in Brazil is from the Amazon River that provides water to local municipalities and to most of the population. There are strong controls over the raw or unfiltered water from the rivers in the Sao Paulo State municipality (Hordijk *et al*, 2014). The National Council on Water Resources stationed there

sets the parameters for the water supply and management programmes. The committees constituting this council have representatives from municipalities, civil society organizations and the state (Hordijk *et al*, 2014). The committees form a platform from which to address issues of common interest, and are informed by their members, who operate against their cultural background and their perspectives on the approach to water as a resource. This water management initiative in Brazil assists in the implementation of water conservation measures, which in their turn are analysed by the head water authorities in terms of the effect that the population has on water (Hordijk *et al*, 2014).

According to Biagi and Ferro (2011) who conducted research on two Argentinian cities (Gualeguaychu and Buenos Aries), household individuals and environmental stakeholders who are actively participating in protecting and conserving the environment have a strong sense of responsibility and also show what is known as an “internal locus of control” (Biagi and Ferro, 2011). These authors believe that such people constitute the centre that links the relevant matters or issues pertaining to water and they need to be involved in environmental conservation. They consider that they have the authority and power to control their lives and assume that environmental problems can be addressed through their contributions (Crawford and Bell, 2012).

These authors asked the household members and environmental stake holders about their perceptions of the availability and sustainability of water consumption on the local level, perceived threats and possible solutions (Biagi and Ferro, 2011). Most of the respondents showed an external locus of control, mentioning key points such as the need to educate, public policy, legislation, cultural change, political decisions, and public campaigns (Biagi and Ferro, 2011). The residents of these two Argentinian cities displayed certain perceptions regarding water conservation, namely that water conservation in a developing country is one of the environmental challenges that needs to be addressed by political authorities through promulgating legislation or improving upon it (Biagi and Ferro, 2011).

2.4 Africa

The United Nations puts the number of people living in countries with challenges in meeting their water needs at about one third of the world population. Furthermore, it estimates that about half of the people in the developing world

suffer from diseases caused by contaminated water (Verdugo and Armenta, 2006). In the past, the implementation of a water supply infrastructure, the operations involved in realizing this objective, as well as the maintenance of the development, were considered to be the responsibility of the government in the developing countries, while users were expecting to have a free water service (Jones *et al*, 2004).

The idea of community management in water supply systems was conceived when the targets were set in place during the 1980-1990 International Drinking Water Supply and Sanitation Decade (IDWSSD) (Behailu *et al*, 2015). The objective of IDWSSD was to bring full access to water to all households in developing countries by the end of the decade (Jones *et al*, 2004; Behailu *et al*, 2015). This highlights the gap that needed to be filled in the African countries in order for their citizens to have access to water. This proved to be an onerous challenge to the households (and the authorities) in that they were required to deal with the conservation of water by households when they did not even have access to it (Oyama *et al*, 2012).

Normal urban African households use water for a wide variety of purposes, from the small measures needed for drinking and cooking to great volumes used for bathing, cleaning, washing, gardening and beer-brewing. In essence, the activities around water use are divided into three categories, namely for consumption, hygienic purposes and recreation (Thompson *et al*, 2000). In some African countries, such as Tanzania and Uganda, research by Gulyani *et al*, (2005) and Thompson *et al*, (2000) found that the high-income-earning urban areas of Tanzania and Uganda receive water on a 24-hour water supply basis whereas the low-income-earning areas, such as Karuriri in Kenya and Dodoma in Tanzania, have only five hours of service in supplying water per day.

As opposed to those households with piped supplies, households in East Africa without access to piped water rely on alternative sources to obtain their water. In Kenya, many households rely on self-provision or alternative water services offered by community organizations (Oyama *et al*, 2012; Thompson *et al*, 2000). Boreholes equipped with mechanised pumps are in operation in formal settlements and act in conjunction via small distribution networks and water tanks to supply water to the people. On the other hand, the communities living in informal settlements get their water mainly from water kiosks or hand carts and rely totally on municipal water supplies (Gulyani *et al*, 2005; Roy *et al*, 2013).

In the urban areas of Nairobi, private households have installed piped water connections in their houses as their primary source of water. It is the high-income Nairobi households that are generally connected to piped water supplies to service a number of different functions (e.g. for gardening, the washing of cars and for swimming pools), which are the most common activities practised (Gulyani *et al*, 2005; Waller and Scott, 2013).

On the other hand, the primary source of water in other less affluent households is from taps in their yards (Gulyani *et al*, 2005). Furthermore, in the case of a minority of low-income households, water kiosks are the most important alternative to piped supplies (Gulyani *et al*, 2005). Since these communities are not connected to a water source. They have to buy water by the bucket and pay exorbitant prices (Spronk, 2010).

The poor pay far more per unit of water relative to their wealthier and connected counterparts and therefore consume far less water than the affluent. Kiosks and water vendors are prominent in informal settlements such as in Kibera, Nairobi's largest slum. It accommodates about 0.5 million residents, with water being provided by about 650 kiosks (Gulyani *et al*, 2005; Thompson *et al*, 2000; Oyama *et al*, 2012;).

Countries such as Botswana that suffer huge scarcities of water are of interest to academic researchers of water supply and conservation in respect of the methods of ensuring the sustainability and availability of their water resources (Jones *et al*, 2004). Urban population growth in towns like Gaborone raises the demand for water while the low rainfall also raises the question of the future water supply for the country. The major problem is that the dominant water management approach in Botswana focuses more on the development of additional water supplies and less on water conservation and demand management (Toteng, 2008).

In 2008, it was evident that some of the towns in certain parts of Botswana were lacking in terms of the realization of a water conservation policy promulgated by parliament (Toteng, 2008). Lack of political leadership in water management as a national resource indicates that the consumption of water around the country has the potential for creating water shortages.

There are three groups of stakeholders, namely the dominant, the discretionary and the dormant (Toteng, 2008; Spronk, 2010). According to Toteng (2008), the dominant or main stakeholders consist of government agencies, the

discretionary or “open” stakeholders of environmental non-governmental organizations (ENGOS) and the dormant stakeholders include all other water users or consumers that do not habitually participate in decision-making in terms of water management and policy process. The dormant stakeholders therefore include all household water users that have not benefited from much water conservation education from the government as the water supplier as opposed to those water consumers in other countries such as Canada (Waller and Scott, 2013). These above mentioned three water bodies groups subsequently merged (Toteng, 2008; Spronk, 2010).

The water pricing policy in Botswana is more active in the urban areas (Toteng 2008). Water pricing is based on equity, efficiency and affordability. Equity means that all citizens of Botswana should have access to safe water to cover at least all of their basic needs. It was mainly in the urban areas of Botswana that communal water standpipes were disconnected in favour of private water connections in order to encourage water conservation. Some poor urban households in the low-income areas were and are still known to be experiencing difficulties in that they could not afford the private water connections.

It was the task of authorities in Botswana on the water-pricing mandate to make water users recognize that water in the country is scarce and expensive to provide, and that the provision of the water resource should be cost-effective. Affordability requires that no one should be denied access to the water necessary to meet his/her basic needs because he/she cannot afford to pay (Smith and Hanson, 2003).

According to Toteng (2008), the following stipulations in a programme to assure a sustained supply of water to Botswana as a whole was devised by the Water Utility Cooperation (WUC). It was directed at residents, encouraging them to conserve water in the following ways:

- The watering of gardens with hoses, sprinklers and irrigation systems should be carried out in the evening only.
- The use of potable water for car washes is allowed only where a water-efficient form of technology is adopted.
- The use of potable water for institutions and hotel gardens is permitted subject to the condition that they should have installed wastewater treatment plants for garden watering.

- The watering of playing fields, sports grounds, golf greens and golf courses is prohibited.
- The washing of pavements using potable water is prohibited.
- The watering of council parks and recreational gardens with potable water is prohibited.
- Institutions should replace all automatic flushing urinals with manual systems.

While it is now almost universal, the term “water conservation” or “water sustainability” is relatively new, especially in the Global South, since most of the countries in this region are still struggling to access quality water from their municipalities. Countries in the Global South face corruption in government circles, higher population growth rates and human settlement challenges, which make the task of supplying water more important than water conservation (Hardoy *et al*, 2005; Thompson *et al*, 2000). According to Randhawa and Marshall (2014), it is predicted that by 2030 the global population will have reached the mark of 60% urbanised, with the Global South countries leading in population growth in the urban areas. The main reason behind the migration of the population to urban centres (i.e. urbanisation), especially in the developing countries, is to access major services such as, amongst others, the delivery of water.

The main idea behind water conservation and of promoting the challenge to conserve, especially in an urban environment, is to provide the urban population with a basic background so that it will develop a perception of the importance of water as a resource, to meet the demand for it and the goal of “water sustainability” for future generations. In its turn, this would have positive impacts on climate change (Ziervogel *et al*, 2010).

When the demand for fresh water exceeds its supply, a water crisis occurs. Seventy nine per cent (79%) of about 844 million people without access to adequate water supplies are from sub-Saharan Africa (Oyama *et al*, 2012). Water is accessible to these people in various ways (e.g. as rainwater, groundwater, surface water and piped water).

The challenge of water management in developing countries such as those in Africa is high on the agenda of their governments. Education is one of the best platforms from which to promote water management among communities. Communities need to be educated about the importance of water before they

learn about modern technologies that assist in preventing the excessive consumption and exploitation of water (Oyama *et al*, 2012).

Proper education on water, and technological and management strategies aimed at making it available to the population are essential for sustainable management in order to provide the grassroots-level communities with the basic skills in handling water issues. The “water-user-pays” policy in urbanised areas in developing countries is gaining in popularity. In this case, a meter box is installed to regulate the amount of water being used. This system helps communities to be careful in the way in which they use water indoors and outdoors (Toteng, 2008).

In spite of their poor socio-economic standing and their inferior household conditions, when it comes to water conservation, countries from the Global South can learn from their counterparts from the Global North. To control the amount of public water being consumed within buildings in the European countries of the Global North, for instance, there are programmes in place to reduce water usage and to enforce daunting water restrictions. Subjective pricing structures, water metering, information campaigns by private organisations, and promotions by government to encourage the use of water-efficient connections also help to achieve important water savings. More importantly, the public participation of residential water consumers is essential. Based on the research that has been conducted on this issue, communities need to play a role in water conservation, much of which is lacking in most of the countries around the globe (Kelly, 2015).

2.4.1 Water conservation in South Africa

Substantial management programmes on water development and conservation have already been undertaken in South Africa. For the most part, they have not met with much success but those that focus on evaluating water management in the South African urban residential context without the help of government are to be commended (Hosking and du Preez, 2004).

Since the first general elections in 1994, the post-Apartheid state has been faced with widespread inadequacies in water service delivery in the townships (von Schnitzler, 2008). Before the dawning of democracy in South Africa, water conservation was not a primary goal for government and households as only certain economically-favoured suburbs in the urban areas had access to water. The majority of township households were found to be more likely to lack access to basic services such as water as opposed to the more affluent suburban and

urban areas (Nnadozie, 2013). This raised the challenge for informal settlements and townships to conserve water. Even today, on account of the history of Apartheid in South Africa basic service delivery in terms of amongst others the provision of water has been sadly neglected in the former black areas. Campaigns for water conservation were focused on storage dams as the main means for the community to source water. Little was in fact done by communities to conserve water (Pott *et al*, 2009; Fan *et al*, 2013).

The current situation with regard to the water shortage in Cape Town deserves mention. Cape Town communities are experiencing water cuts from their municipality because of the excessive demand for water in terms of the limited supply of this resource around the city. This situation is affecting everyone regardless of their economic status. Both the rich and the poor are being affected.

As people flock to the cities mainly for employment the high rate of growth of the population in urban areas puts pressure on the urban water supplies Cape Town might be affected by this above results of population growth (Naidoo and Constantinides, 2000). Water conservation programmes such as in educating people about the value of water and how to conserve it form part of the campaign to convince communities to address this important matter (Chetty and Luiz, 2014; Xiong *et al*, 2016).

The people of South Africa live in different types of residential units varying from informal shacks to modest semi-detached and free-standing houses to urban mansions. Water is an essential commodity in the lives of all these people no matter what the type of residential unit in which they live (Sherwill *et al*, 2007). South African Water Policy emphasises that the provision of water is essential as a basic service to a community (Goldin, 2010; Bawa, 2011).

People living in urban residential structures rely mainly on the local government for essential services such as the provision of water. However, not much research has been done by South African scholars on investigating the various household backgrounds of residents in different spatial locations and comparing the associated methods that they are using in terms of water conservation (Massoud *et al*, 2013).

Water has an economic value in all of its complementary uses. The emphasis should perhaps be on the contribution that a poor community might play if it were to conserve water. Public participation with the government could contribute to

the development of strategies that communities could adopt in their quest to conserve water (Nleya, 2008).

The responses of urban communities such as those residing in urban areas need to be heard when practices such as water conservation are applied to them. Water conservation procedures are powerful instruments if the communities that use the water are involved and feel free to make recommendations in respect of water crises and issues (Nleya, 2008).

Because South Africa shares its water resources with neighbouring states, this issue has proved to be a challenge for this water-deprived country, especially on the natural-resource-use front (Oyama *et al*, 2012). In the light of the onerous prediction that the ever-increasing population will demand more water, the importance of water conservation must be highlighted. The water problem in South Africa needs to be approached by implementing appropriate water management processes and technologies, by effectively incorporating stakeholder inputs such as community campaigns and operations, by implementing policies and adapting legislative measures effectively, and by introducing a holistic approach (Oyama *et al*, 2012).

Most South African urban environments have access to water services. Even informal settlements around cities have access to communal pipe water. The question in mind is the manner in which the respective communities with their different socio-economic backgrounds could gain access to and consume water, and whether the type of settlement unit in which they live is likely to influence the way in which they obtain and use water (Nnadozie, 2013).

2.4.1.1 Water policy in South Africa

The South African Water Policy aims to provide all citizens with access to water as a basic service to meet this basic human need (Gualitieri, 2007). The prevalence of drought in South Africa has put more pressure on the Department of Water and Sanitation, local municipalities, and the government in their quest to fulfil one of the constitutional rights of all citizens of South Africa, namely for each citizen to have access to clean running water. As a result, large cities, such as Cape Town, Durban and Johannesburg, are playing a leading role in South Africa to distribute water and to maintain adequate supplies of it to benefit all citizens (Robson, 1997; Rogerson, 1999). These issues call for communities to participate and contribute what they know to dealing with water issues in a positive way (Smith and Hanson, 2003). The main question of water supply in

South Africa is based on equity, the line which divides those with adequate access to water from those without enough access to water. Water for domestic or primary consumption always receives priority in South Africa (Pott et al, 2009). During the early nineties, there was a belief that public funds available for the development of water supplies would be invested mainly to ensure that huge volumes of water would be made available to those who could afford to exploit them (Sherwill *et al*, 2007). This has benefited farmers who can install pumps to take water from rivers as a source to irrigate crops, and municipalities which build plants to extract and purify water to sell to their citizens. That left poor communities lacking in both funds and the organisatory abilities to take advantage of their right to access primary water supplies (Chetty and Luiz, 2014).

United Nations make some research prediction that in developing countries such as South Africa water is already a global problem since the increasing population and the survival and welfare of humankind depend on economic and social development and the availability of resources as water is the most crucial resource. Since the demise of Apartheid in 1994, there has been an increase in the number of nationals and internationals streaming in to the South African townships to access opportunities of earning money in the cities (Vearey, 2010; Nnadozie, 2013). As a result of the population pressure, water shortages are being experienced in the South African townships, the local authorities of which are being pressurised to fulfil the demands of the people and the environment for water (Madlener and Sunak, 2011). South Africa has a long history with water as a major challenge. To overcome this problem, the country gets its water from, amongst others, the neighbouring country of Lesotho (Randolph *et al*, 2008).

2.4.1.2 Recycling and reuse

Water resources in South Africa are used for different purposes - from indoor to outdoor functions (Beekman, 2010). Water can be considered as a renewable resource when it is recycled (Sadalla *et al*, 2014). The demand for water in the face of limited supplies is becoming a problem in the urban areas of South Africa. Therefore, its reuse is becoming an important component in the planning, development and overall usage of this resource in urban households (von

Schnitzler, 2008). The use of non-potable wastewater by households for outdoor functions such as gardening potentially represents a viable substitute for treated and potable water (Beall *et al* 2000). Recycling also ensures a reliable supply of water during dry periods as the volume of urban wastewater is hardly affected by drought (Beekman, 2010). Water conservation management measures are essential as part of recycling and reuse and should include information techniques to bring consumers in touch with the national water consumption figures to make them aware of the importance of conserving this vital resource (Tumbare, 2015).

In the South African context, water conservation should be practised by both the communities and the authorities by reusing waste or grey water to useful water. It is neither sensible nor sustainable for the authorities, for example, to continue increasing the amount of water available to meet the projected future demand, especially in urban areas experiencing high population growth as in Soweto in the Greater Johannesburg Metropolitan Area in Gauteng (Muller, 2008). Governments in conjunction with communities can promote projects such as the safe re-use of effluent, rainwater harvesting, the desalination of seawater and brackish water and the conservation of traditional sources around urban communities as recommended water conservation practices (Fan *et al*, 2013).

Urban areas such as Durban that are on the coastline can use sea water for flushing toilets in the local households in order to conserve the limited reserves of freshwater (Naidoo and Constantinides, 2000; Beekman, 2010). On the challenging side, desalinated sea water ranks as the most expensive source of water when compared to other available sources. The practice of the desalination process of reverse osmosis through membrane technology is virtually non-existent in South Africa on account of the high costs that it would place on the water authorities. Should such a development transpire, however, the water derived from that source (desalination) would represent an additional input to supplement the water supply (Beekman, 2010).

Another stumbling block in thwarting efforts to exploit different sources of water is that communities are often prejudiced against the use of groundwater and surface water as a result of contamination. Non-potable drinking water and people's perspectives on it pose serious problems for water usage throughout the urban environment.

2.4.1.3 Integrated water resource management (IWRM) In South Africa

Integrated water resource management (IWRM) has been defined by the Global Water Partnership (GWP) as a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment (Mehta *et al*, 2014). Thus IWRM has been accepted as the central model in water resource management. The leading projects of multinational global bodies such as the GWP have been promoted with much dynamism by a variety of multidimensional and bilateral donors and financiers. As such, van Tonder (1999) believes that IWRM is a remedy for addressing the water management crisis in Southern Africa.

As mentioned above, the main concept that defines IWRM that was adopted from the Dublin Water Conference (31 January 1992), promotes the coordinated improvement and management of water in order to maximize economic and social welfare in a just and fair manner without compromising sustainability (Mehta *et al*, 2014). IWRM has become a water policy especially appropriate in countries like South Africa (Paul, 2009). After the democratically elected government came to power in 1994 in South Africa, the White Paper on Water Policy, followed by the promulgation of the National Water Act in 1998, signalled a key shift in the country's management of water (Mehta *et al*, 2014; Department of Water Affairs and Forestry, 1992).

Naidoo and Constantinides (2000), are not in agreement as to the positive influence of IWRM and its progress in water management since they believe that this plan is lacking in that it does not highlight the issue of lack of access to water in South Africa. Most people in South Africa are still denied access to the basic delivery of water through the government. This situation has caused challenges in devising examining strategies that are directed at investigating the perceptions of household members regarding water conservation (Naidoo and Constantinides, 2000; Oyama *et al*, 2012; Hordijk *et al*, 2014; Mehta, 2014).

These authors agree that the implementation of water conservation and water demand management are the key drivers to promote efficient water use in South Africa. The implementation of water conservation and the water demand paradigm is essential not only for the sustainability of water and the environment but also for economic efficiency (Naidoo and Constantinides, 2000).

2.4.1.4 Perceptions and attitudes concerning water

It is challenging to understand people's attitudes towards various aspects of water supply. Furthermore, it is not easy to change the associated choices that they make in terms of water issues (Syme *et al*, 2000). Syme *et al*, (2000), evaluations are made of a community's behaviour in terms of its consumption of water and its inadequacy in conserving this precious resource. In fact, the focus falls on the difficulty of forcing people to conserve water. The afore-mentioned study indicates the positive side of water conservation in terms of recycling and renewal processes.

Limited work has been done by researchers on human perceptions and behaviour in respect of water issues, especially on comparing developing countries to developed countries. Research in the developed countries tends to focus on water consumption and how it is associated with social status. The more money that people earn, the greater the advantage they enjoy in consuming large quantities of water, especially in terms of outdoor facilities such as swimming pools and gardens (Coleman, 2009).

Worldwide, there has been a healthy growth in consumer demand for bottled water because of the general perception that it is non-toxic, is of better quality, and is associated with naturalness. As opposed to developing countries, most bottled water is consumed in developed countries. Behavioural change is a key component when it comes to water conservation in different communities. Most communities use water for human requirements such as drinking, cooking, cleaning and washing (Beekman, 2010).

Negligent attitudes pertaining to personal and public responsibility and behaviour regarding water are associated with the limited knowledge level of the community in question. More commendable attitudes to these aspects of water generally pertain in better educated and more knowledgeable communities.

Cockerill *et al* (2015) found in their research in Georgia (USA), that communities believe that rather than individuals, industry and agriculture contribute more to problems regarding the availability of adequate quantities of water. As an indication of their positive attitudes to the conservation of water as a commodity that needs to be protected, Georgian citizens supported the imposing of prices in line with water consumption levels (Cockerill *et al*, 2015). Factors such as experiencing drought or being educated in the issues surrounding drought can

influence an individual's attitudes to water conservation regardless of the country in which he/she lives or the socio- economic history of his/her community .

Climate change can force a country to change its attitude to water conservation irrespective of its historical background and previous attitudes with regard to the conservation of water. Clark and Finley (2007a) also agree that an awareness of climate change and politics are significant factors that come to play in a person's intention to conserve water. This is highlighted in the research on this topic in Bulgaria: the more aware and informed a person is about climate change, the more likely he/she would be to implement water conservation measures in his/her own home.

The following five variables were predicted by Gilbertson *et al* (2011) to influence communities regardless of their economic status and geographical location:

- Attitude predictors: attitudes, subjective norms and behavioural control
- Belief predictors: environmental beliefs, ecological world view, and water-specific beliefs
- Habit and routine predictors: clothes-washing habits, showering habits and general water-usage habits
- Personal capability predictors: age, education, income, occupation and knowledge
- Contextual factor predictors: number of residents per household, home ownership, water pricing and type of home.

The variables listed above are the main influences affecting an individual's perception of water usage and conservation. Most people tend to highlight one or more of the above as the reason why they conserve or waste water (Gill *et al*, 2009).

2.5 Conclusion

This chapter contextualizes the study by highlighting some recent transformations in international policies on water distribution and conservation practice. Various countries across the different continents experience water conservation in different ways, which are based on their level of development and their progress in water conservation and their research into assessing the behaviour of communities in terms of water issues.

Developed countries (especially in the Global North) consider the daily conservation of water as the norm in their households. Developing countries

appear to struggle with water conservation measures as they are still addressing the issues of access to water and the provision of clean water as their main concern. It appears to be a great challenge, especially in the case of lower-class residents, to understand water conservation and to perceive it as the main issue, as some are struggling to access water in adequate quantities for their own personal use.

Most of the countries in the Global North focus on urban areas for the application of water conservation measures, since urban population growth is prevalent in these countries. Education, even from the elementary grades at school, has played a huge role as one of the means for promoting conservation measures in densely populated countries such as China. Yet another positive force in this respect has been the water meter, installed in modern housing developments, a modern trend in developed countries. Two main points that emerged from this literature review are that developed countries conserve water with the assistance of government and water authorities, whereas on the other hand, in the developing countries, it is the personal role of the individual that is significant in accessing and conserving water.

Chapter Three

The Research Methodology

3.1 Introduction

The purpose of this chapter is to discuss the research methodology that was applied in conducting this study. Placed within the context of qualitative methods, the chapter provides details concerning the way in which this subject of this thesis was researched, being based on the gathering and analysis of information and data.

This chapter begins by describing in general the nature of qualitative and quantitative research methods respectively. It then proceeds to discuss these two methods that are considered to be the main methodological tools for this study. Thereafter, attention is given to the process of data collection, which is explained alongside the rationale behind the selection of particular methods and techniques. Lastly, it provides a critical reflection or overview on the research process.

The challenges or limitations that this study had was to lack of the information based on water conservation approaches by household. The lack of normal methodology that used before on capturing households to participate in the research is one of the main tactics need to be resolve in future.

3.2 Study Area

3.2.1 Introduction

The geographical focus of this study is two residential areas in Johannesburg, namely Meadowlands and Florida, that accommodate communities with different socio-economic back grounds. The study specifically targets a number of economic and social variables associated with the respective communities that impact upon their attitudes to water conservation and supply. Meadowlands and Florida differ in respect of the distribution of services/resources that they receive from the municipality. One of the main reason to do research in Meadowlands and Florid. These two locations are not far one another, Meadowlands used to fell under Apartheid legislation while Florida was more advance as it was accommodating elite class of people. The large number of housing in Meadowlands and the way they access water was the one of the main reason for this area to be chosen.

3.2.2 Background to the Study Area

3.2.2.1 Meadowlands

Meadowlands, a township located in the northern portion of Soweto, in the Gauteng Province of South Africa, is located at 26°13'15"S 27°53' 58" E. It was founded in the early 1950s during the Apartheid era for black residents from Sophia town. It is a well-known multicultural township on the outskirts of Johannesburg, the largest city in South Africa.

Many migrants flocked to Johannesburg in earlier times for employment during the Gold Rush of the early 1950s and settled here and in other Soweto townships (Vearey, 2010). Figure 1 displays the study area, which extends across 11 square kilometres and accommodates a population of 138 354. The population density is 1 196 people per square kilometre, while, with the number of households in the area amounting to 35 814, the household density is 3 095 households per square kilometre. With the number of female members of the population in this area amounting to 70 467, and that for males amounting to 67 888, the gender ratio for the population is around 50%, with females dominating (Lehohla, 2011).

3.2.2.2 Florida

Vogelstruisfontein and the farms Roodepoort and Paardekraal were established as mining camps after the discovery of gold in 1881. Florida was laid out in 1889 and then proclaimed as the suburb the following year on 14 April 1890. By 1904, it had become a suburb of Roodepoort. It was either named after Florida, in the USA, or after the founder of the suburb, namely Hendrik van Hoven, whose late niece was called Florrie (Vearey, 2010).

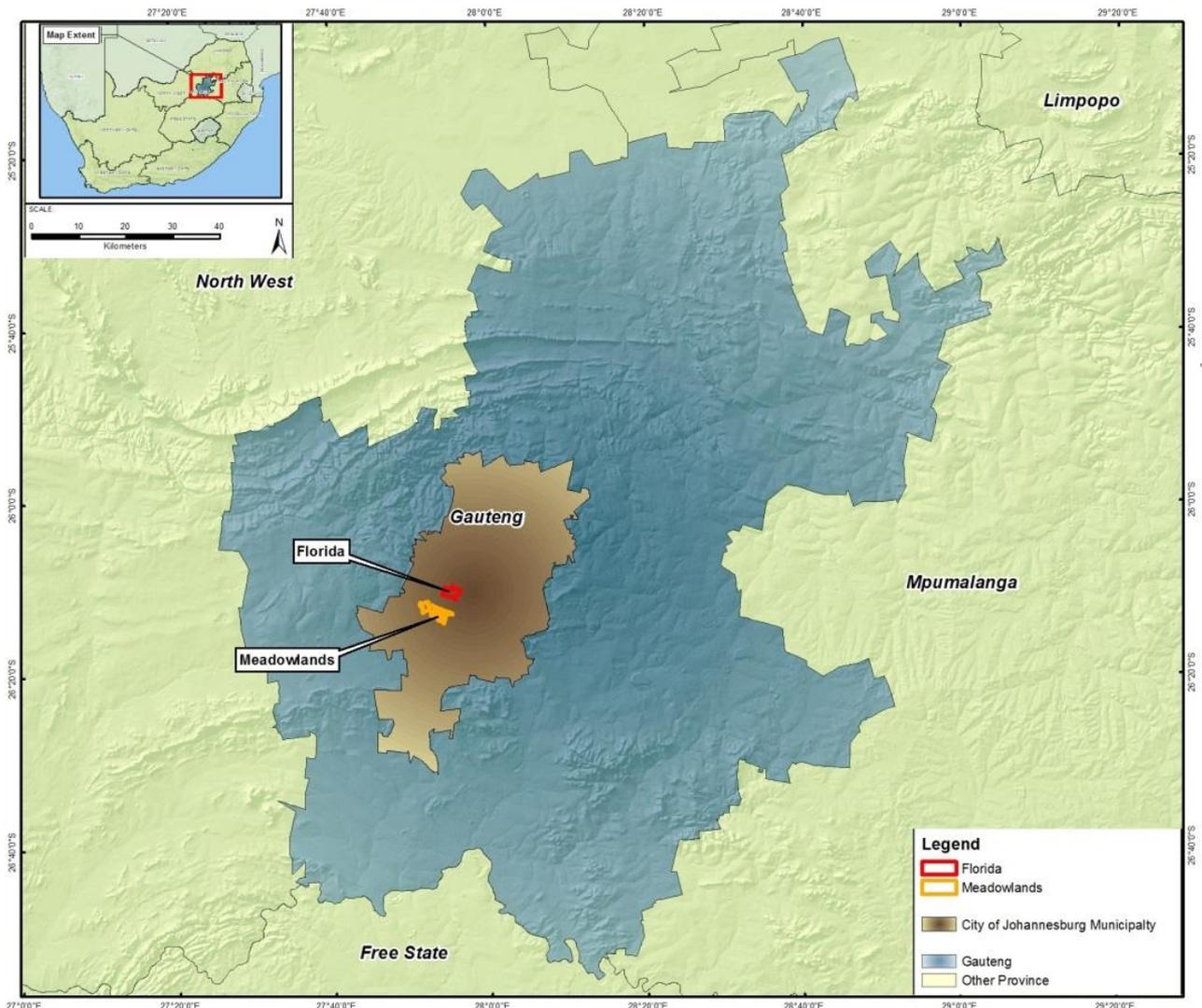


Figure 1: Map of Gauteng province showing Meadowlands and Florida

Figure 1 also shows the geographical location of the suburb, Florida, in the municipal area of Roodepoort in the Gauteng province of South Africa. Lying west of Johannesburg, Florida is located at $26^{\circ} 17' 5''$ S $27^{\circ} 9' 23''$ E. The people living in the area are of a better socio-economic class than those living in Meadowlands. There is no evidence of any informal settlement in Florida. The area was initially designated only for white residents during the regime of the Apartheid government but it is now a multi-racial area, accommodating South Africans, as well as some foreign nationals (Lehohla, 2011). Although Florida was declared as a white area during the Apartheid era, more than half of Florida's residents today are coloured. This is mainly because it is in close proximity to the coloured townships of Bosmont, Coronationville, Newclare,

Westbury and Riverlea. The main road through Florida, Goldman Street, forms the spine for local business activity and civic services. The local library is one of the best facilities of its kind in Johannesburg. The eastern end of Goldman Street is home to a number of antique dealers specialising in Africana furniture.

The population accommodated in the residential area of Florida, which extends across an area of 632 square kilometres amounts to 20 082 people which means a density of three people per square kilometre, while the number of households, amounting to 6 970, signifies a household density of 1 103 households per square kilometre (Census, 2011).

The Johannesburg Metropolitan Area extending into surrounding areas such as Meadowlands attracts thousands of new residents every year in search of work and a better life (Vearey, 2010). The provision and distribution of water, a necessity for survival, is important, especially in urban areas, where there are higher population densities and the residents are from different backgrounds. As such, they also have different perspectives on water supply and conservation.

Meadowlands receives its water from the Johannesburg Metropolitan Council, which distributes water to different types of housing units such as shacks in the informal settlements and formal houses in the better areas chosen by residents of a higher socio-economic standing. Most of the people from the informal settlements use communal pipes to access water, whereas those residing in formal houses use house taps (Census, 2011).

Florida, on the other hand, is largely made up of formal houses and flats. Water taps are installed inside the houses, while water meter boxes record the consumption of water on a minute-to-minute basis. This aspect is monitored by the municipality and charged for accordingly. The meter box also gives the head of the household an idea of the amount of water being consumed on a daily basis. As such, water conservation is being promoted through the municipality in that the meter box is read by the household head/a municipal official to determine how many litres of water are being used a day. This figure is associated with the amount of money to be paid the greater the amount of water, the higher the bill (Dlamini, 2012).

3.3 Qualitative research Method

3.3.1 Introduction

This study was conducted over a period of two years and research data were collected from the offices of the Province of Gauteng, with field work being conducted in Meadowlands Township, Soweto, and Florida, Roodepoort. The reasons for selecting these two residential areas for research include their proximity to each other, the increases in population and the expansion of their respective borders over time that they both experienced, as well as the significant effects that both were subjected to as a result of history in the form of separate development and Apartheid . Florida became home to an elite class of people while Meadowlands was home to the poor (Heppner *et al*, 2007; Cadwallader, 2009). What interested this researcher was that these two residential areas have a different socio-economic history but get water from the same municipality.

3.3.2 The method of research to compare the two residential areas

Subsequent to being granted ethical clearance by the University of South Africa (UNISA), this researcher started the data collection phase of his research in April 2017. Both primary and secondary data sources were used during the research process. Primary data comprised of questionnaire interviews and observations. Written primary sources included relevant municipality documents and statistical data obtained from Statistics South Africa about the areas (population numbers) and their history in terms of water issues, as well as from literature on water-related issues in developed and developing countries, including South Africa specifically (Lehohla, 2011). Each of the participants gave consent form before his/her participation and noted that the interview was not being recorded. Notes were also taken during the interview but only if the participant mentioned some fresh, critically important information related to water supply and conservation (Holloway and Wheeler, 2010).

Each of the participants gave consent form before his/her participation and noted that the interview was not being recorded. Notes were also taken during the interview but only if the participant mentioned some fresh, critically important information related to water supply and conservation (Holloway and Wheeler, 2010).

Because Meadowlands is a large township accommodating a total of 35 814 households, while Florida has a total of 6 970 households (Lehohla, 2011), cluster sampling proved to be the best suited method of sampling for this

research project. The parameters of the random sample were selected with a margin of error of 10% and a 90% confidence level as a guideline (Raosoft sample, 2016). As such, a random sample of 67 households in Florida was selected to participate in the study as against the random sample of 68 households in Meadowlands. As these two communities were interviewed using raosoft sample as a methodology its because the aim was to get a good distribution from two areas.

The data collection process began in Meadowlands Township in Soweto, and was followed up in Florida. Local residents were interviewed on the basis of a questionnaire about water conservation in their households. The percentages were given derived from those participants were interviewed and data from Statistics South Africa 2011.

During the interview process, house owners were warmly welcomed to participate in the research. The interviewees answered most of the questions honestly they were elaborating daily challenges they faced on water issues and some residents were highlighting opinions on strategies that they applied on water conservationj. Some residents focused on the water leaks from taps and rusty and broken pipes outside and inside their houses.

The interviews conducted in Florida took less than thirty minutes for each household, depending on whether the participant understood the research method, and manner in which to answer the questions. Most of the participants managed to fill in the questionnaire on their own. On other hand, each interview in Meadowlands lasted for approximately 90 minutes on average. This was due to the nature of conversing, especially in the case of the elders. The interviews with senior household members, in particular, were conducted in the local vernacular language and were later translated into English.

The months of April and May 2017 were devoted to the interviews. The age of the interviewees was from eighteen years of age and older. At both community sites, the interviews were conducted with household heads or guardians, in cases where the former were not available.

The selection of participants for the research study was conducted through the random sampling method. Thus, the participants could be chosen randomly from larger populations of households. The random selection was conducted in such a way that each member of the population had an equal chance of being selected.

Each household member was interviewed during the research, above 18 years old family volunteered to be interviewed based on his or perspective in water.

This research project made use of probability sampling, specifically cluster sampling. Cluster sampling is used in cases where the population being studied is spread out over a large area, thus making it impossible to make a list of everyone living in that area (Yin, 2011). The area was then subdivided into clusters or precincts. Within these clusters, a subset was selected at random. Therefore, the sample was made up of people within each of the chosen clusters (Leedy and Ormrod, 2010; Hoggart *et al*, 2014).

3.3.1 Qualitative Research

This research study was grounded in a qualitative research methodology. This approach proved to be the most appropriate one for obtaining answers to the research questions posed in the study (Aitken *et al*, 2006). The following sections detail why this is so.

Despite the fact that qualitative research is now widely used in social science scholarship, various authors writing about the different types of research methodology point out that this paradigm is difficult to define precisely (Legard *et al*, 2003; DeLeyser *et al*, 2010). One of the reasons for this lack of clarity is that the qualitative method is grounded in different schools of thought which are not always compatible (Ritchie and Lewis, 2003). However, the multiplicity of philosophical approaches has not prevented different writers from offering working definitions or identifying a set of key characteristics (Denzin and Lincoln, 2000; Tracy, 2013).

3.3.2 Data Analysis

Data analysis is an analytical approach that is widely used in critical geography particularly, and in various other disciplines (Bartley *et al*, 2014). Essentially in this study, is used to examine the framework of texts and verbal accounts so as to explore the relationships between social variables of Meadowlands and Florida resident (e.g. economic, gender and education) and the consumption and conservation of water (Temple *et al*, 2004). Data analysis is concerned with the way knowledge is acquired and shared, with the emphasis in this study being on how social realities are cognitively conceived in water use and interpreted for social action (Christensen *et al*, 2011). Another key aspect about Meadowlands and Florida based on data analyses is that it enables the researcher to carry out critical research whereby the relations between socially cohesive elements in

contemporary society and social attitudes to water resources and conservation can be investigated and analysed (Gee, 1999; Dworkin, 2012). Which location is more advanced with water conservation practices and which location doesn't apply.

The aim of such analysis is to deconstruct matters and truths and knowledge in order to formulate normative perspectives which can facilitate social change in water conservation in this context. Thus data analyses can be viewed as "a methodology for emancipation" in Meadowlands and Florida water issues (see Gee, 1999) as its focus is largely towards attaining what is known as a "semiotic democracy," that is a society where there is a diverse mixture of views and discourses that affect the extent and quality of the environmental debate.

Data analyses prepare a successful exercise in Meadowlands and Florida as a large variety of different sources, including conversations, interviews, speeches, written documents and media reports, may be analysed discursively (Brown and Yule, 1983). While this means that data analyses can be based on the analysis of documents and conversations, its focus is always on the content and structure of the discourse and what this conveys (Sayago, 2015).

Data analysis may also focus on how interactions are conducted or performed, with the analyst examining linguistic styles, rhetorical devices and ways in which talk and text set out to convince and compete with alternative discourses that define reality differently (Ritchie and Lewis, 2003). The actual analytical process employed in data analysis involves teasing out meaning within its context and identifying the overall structure in the data with the aid of graphs since they, amongst others, allow for a lucid interpretation of the results of the questionnaire, capture the analytical process and also the role of the discourse analyst in, in the case of this research, water issues (Gee, 1999).

For Lantham, (2003) a discourse analyst, the purpose of research is not to get behind the discourse, but to find out what people really mean when they say this or that, or to discover the reality behind the discourse (Lantham, 2003). In analytical research into discourse the primary exercise is to sort out which of the statements about the subject in the research material are correct and which are wrong. On the contrary, the analyst has to work with what has actually been said or written, exploring patterns in and across the statements and identifying the social consequences of different discursive representations of reality emphasised in the original discourse. In this way, data analyses enables one to examine how

language is used to communicate for a specific purpose in the particular contexts. The next section outlines the practicalities of the research process (Sayago, 2015).

3.4 Conclusion

This chapter discussed the research processes and procedures followed in undertaking the study. Since the study is placed within the urban context of critical geography, a qualitative research approach was adopted. The chapter began by discussing the nature of the qualitative paradigm and its related research methods. This was followed by a discussion of the process involving interviews with participants for completing the questionnaire, as well as an interpretation of the completed questionnaires through discourse analysis. Thereafter, procedures which were undertaken in conducting the study were explained alongside the rationale for the selection of particular methods and techniques. Raosoft sampling was the main method used to getting the number of participant under qualitative method. It designed and set the questionnaire question as they were covering all gender and age from 18 to above.

Chapter Four

Results and Data Analysis

4.1 Introduction

This chapter provides information on water related issues such as water sources, socio-economic standards, along with gender composition with respect to water conservation. Its purpose is to give context to the study by providing an account of perceptions around water usage and actual water conservation practices in Meadowlands and Florida respectively. This is a highlight in results and data analysis on water conservation based on the data was found in Meadowlands and Florida. In discussion chapter, there will be more on the main water uses as it goes along with relations with households interpretation on water conservation.

Findings emerging from the analytical process as described in the research methodology are presented. This section begins by focusing on gender, which plays some role in the usage and conservation of domestic water especially in cases where couples live together and divide household activities. The chapter serves as a reference for the reader prior to the presentation of the results of the research discussion. These findings will be discussed in detail in the chapter that follows.

4.2 Relationships between social variables and water

4.2.1 Social Background

The interviewees in Meadowlands who completed the questionnaires were mainly females. Most of the households responding to the research questions in Meadowlands lived in formal government-funded houses and there were only a few from informal settlements. On the other hand, the Florida respondents were from formal houses and apartments.

It was noted that on occasions where there were both female and males participants present, the females were the ones who volunteered to participate in the research. A number of these female respondents emphasised that they are the ones who deal mostly with the indoor household activities, especially those that require the use of water, and would therefore provide a more accurate response. This finding was consistent in both study areas (confirming work by Chetty and Luiz, 2014).

The research questions that were posed were the same for both locations investigated in this project. As Figure 2 portrays, 25 males and 56 females (n=81) were interviewed in Meadowlands whereas there were 39 female and 27 male respondents(n=66) in Florida. The graph below represents residents directly connected with the use of water shows a preponderance of female households.

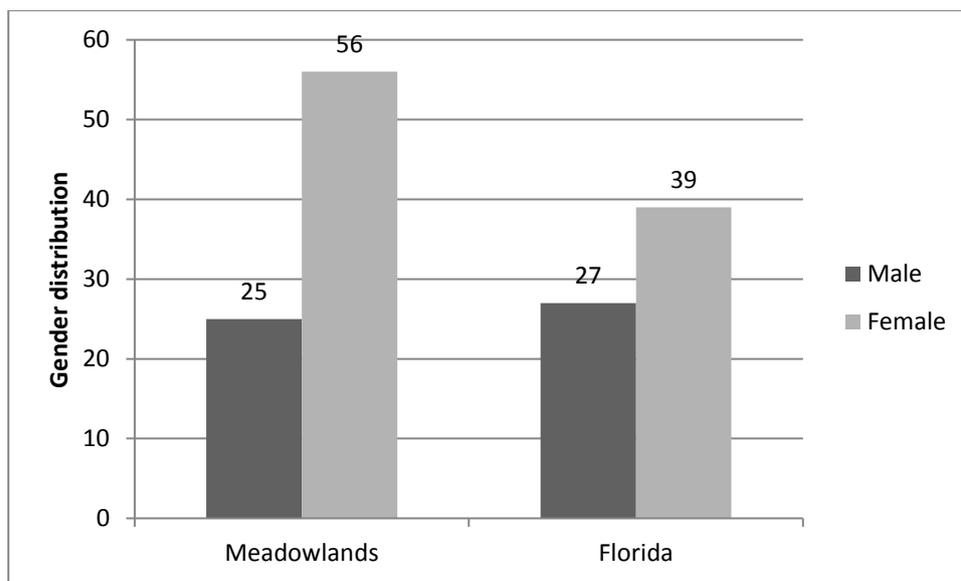


Figure 2: Gender comparison between Meadowlands and Florida

The majority of people of the age of 50 and above (see Figure 3 on the following page) in Meadowlands were found to be females who are responsible for water issues in their homes. On the other hand, in Florida, the largest number of residents that participated in this research study were females between the ages of 22 and 30 years (Figure 3). Adults of 50 years and older who took part in the research constituted the lowest percentage category in Florida. On the other hand, there were no male participants of 18 to 20 years old in Meadowlands. Additionally the females in that age group that participated in the Meadowlands survey proved to be fewer than those in the same age group in Florida.

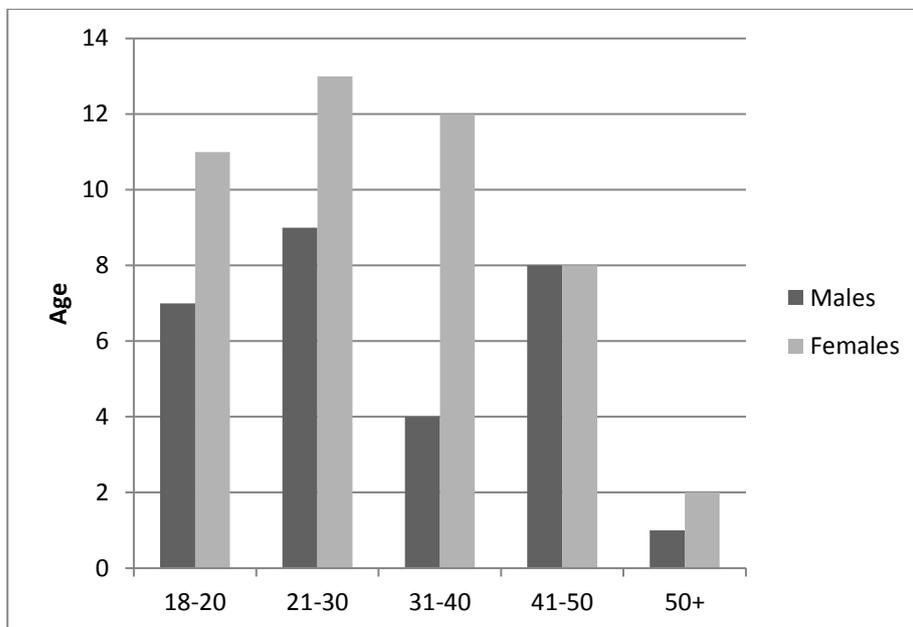
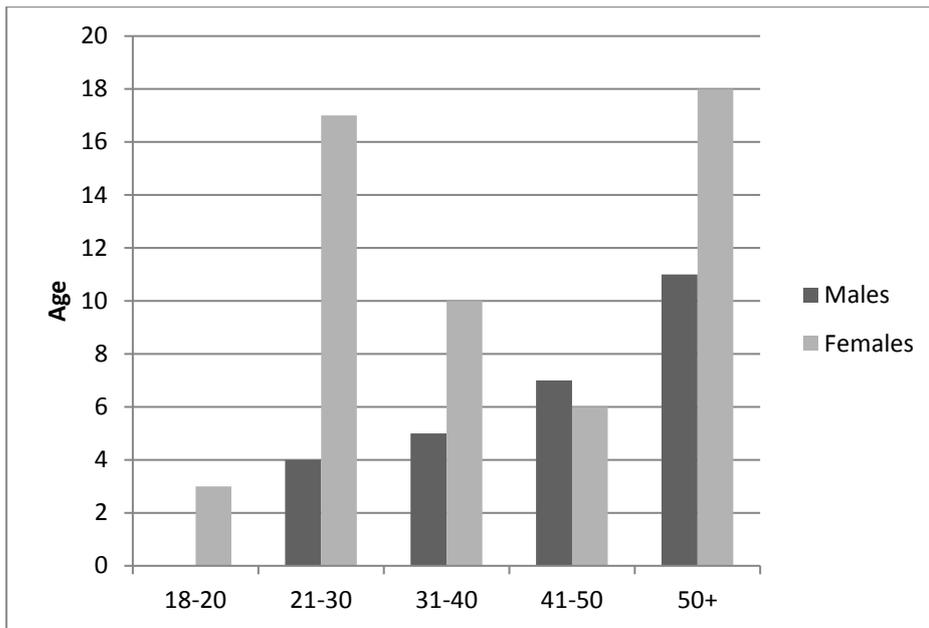


Figure 3: Age distribution in Meadowlands (top) and Florida (bottom)

According to Figure 4, most of the interviewees went through secondary school, with only 3%, in Meadowlands and 2% in Florida not having attended school at all. The educational level reached in Florida was found to be higher with respect to tertiary studies than that for Meadowlands. The majority of respondents in Florida had a tertiary education (40%) followed by a smaller proportion (31%) who had earned a matric qualification. The converse applies to Meadowlands where the greater proportion of respondents had a secondary educational qualification (41%).

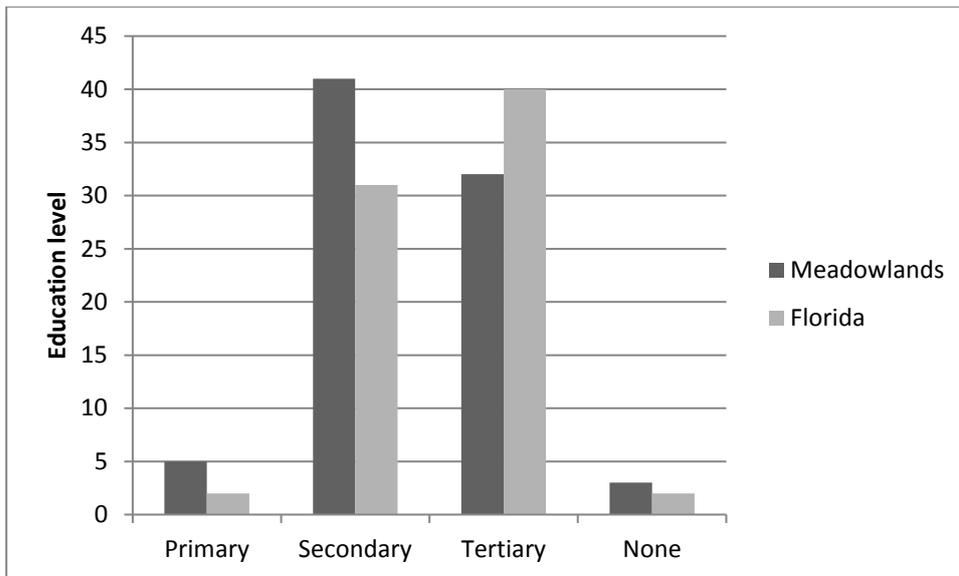


Figure 4: Comparison of educational levels in Meadowlands and Florida

According to the completed questionnaires, a large number of people in Meadowlands were found to be unemployed (more than 50%) (Figure 5). The majority were males (50%) as opposed to unemployed females (5%). More females (6%) than males (3%) were found to be self-employed.

In Florida, on the other hand, 27% of the males were employed as opposed to the 10% of employed females. Unemployed persons constituted 33% of the total number of people in the suburb, while only 4% of the males were self-employed. These employment statistics indirectly influence access to water and the efforts of residents at water conservation, as those who are employed are likely have access to water while those who are unemployed do not have the income to pay for water services and might have to rely on communal pipes or other free water sources .

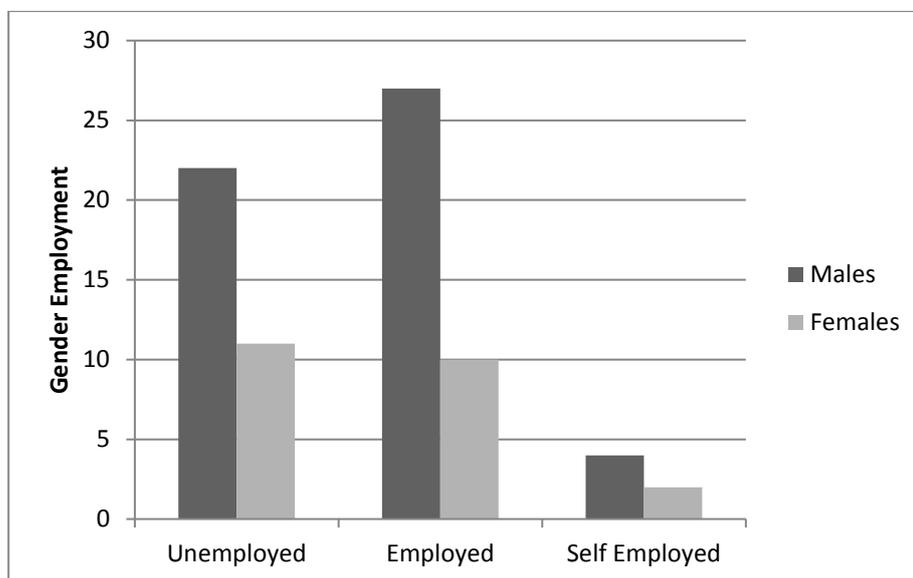
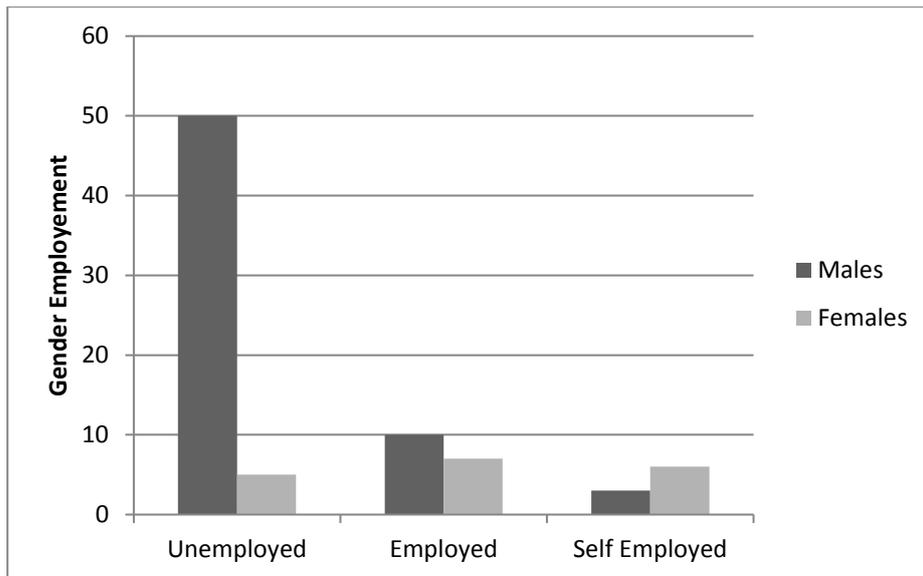


Figure 5: Levels of employment in Meadowlands (above and Florida (below)

The largest category of respondents in Meadowlands was found to be earning between zero and R2 500 a month (Figure 6), with more males (35%) than females (20%) earning this amount per month. For most of the income levels in Meadowlands, the males were found to be earning more than the females except for the R5 500+ per month category where females were found to be leading (7%) as opposed to the males (6 %).

However, in Florida, the males dominate in all income categories. It is evident from figure 6 that 25% of the respondents in Florida are earning around R5 500 per month, with 17% of them being males and 8% being females. These relatively high income levels for Florida are interlinked with the relatively high level of employment in this suburb which might have an effect on water issues.

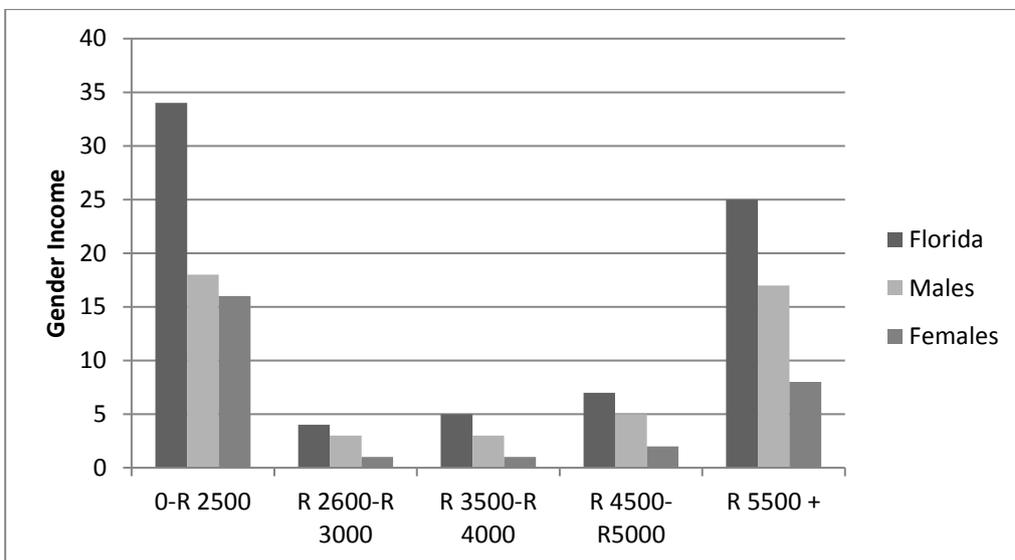
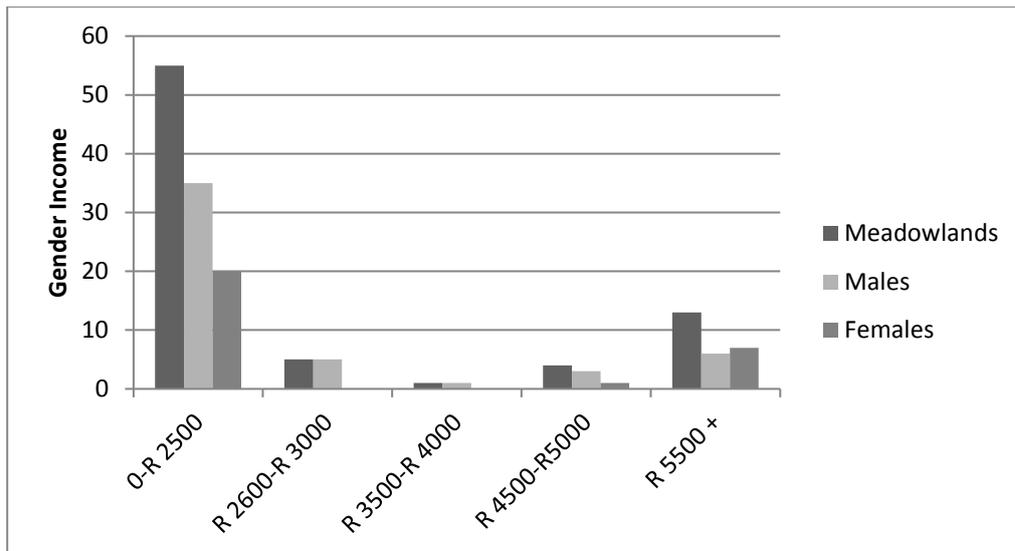


Figure 6: Levels of income in Meadowlands (above) and Florida (below)

Level of education, source of income and the level of income reveal much about the residents of Meadowlands and Florida and these variables can be expected to impact upon the water issues of the residents from these areas. Household members with higher educational qualifications would be expected to have a better chance of finding good jobs with good salaries that might allow for relatively easy access to water and opportunities for buying water from reliable sources.

4.3 Water source

The aim of this study is to investigate and critically compare and evaluate the methods of water usage and conservation as perceived and practiced by residents of selected households in the Soweto township of Meadowlands as opposed to those well as in Florida, a suburb on the Westrand. Towards this goal, this study further assesses the behaviour of the respective communities in terms of water consumption and conservation in the context of the respective socio-economic classes to which they belong.

According to Figure 7, more than 70% of the households in Meadowlands get water from the Johannesburg municipality. Only 6% of the households have access to water from the provincial government. This implies that the residents of Meadowlands rely on local government to fulfill their daily need for water. They understand the significance of water as a vital resource necessary for their existence and survival.

When questioned about water supply, both of the residential areas selected for this research revealed their huge reliance on the municipality for water (over 65% in both cases). Around 6% from Florida indicated that they get borehole water from private stakeholders or buy water from supermarkets (Toteng, 2008). This suggests that some Florida residents are in a better place financially as opposed to the Meadowlands residents. The respondents in Florida noted that they cannot always rely on municipal water as there are times when there are unexpected water outages or cuts with no explanation from the authorities.

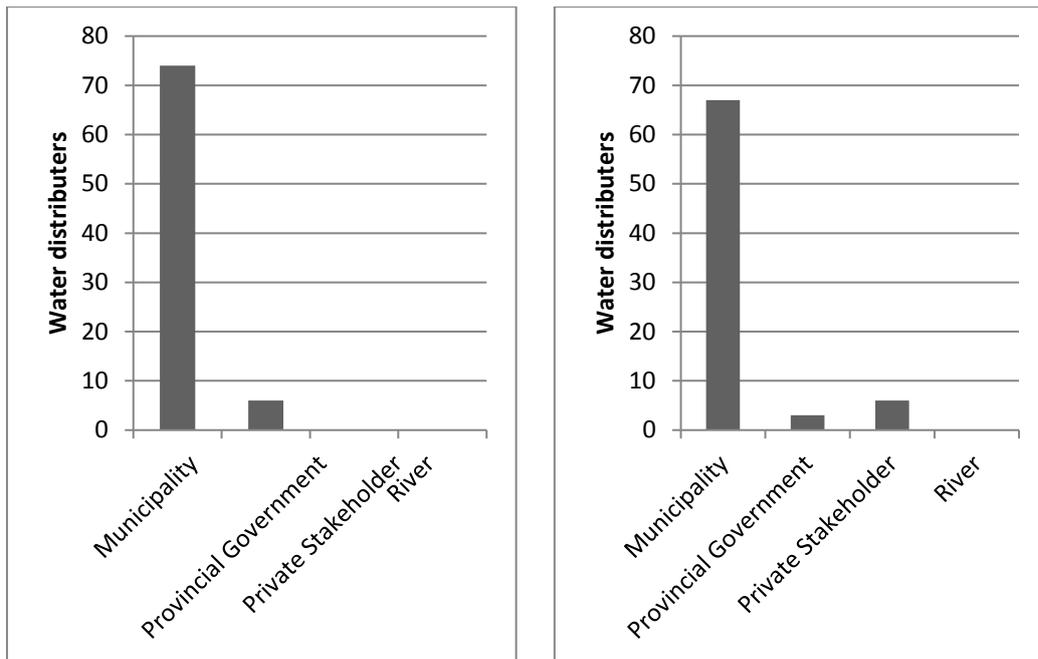


Figure 7: Source of water in Meadowlands (left) and Florida (right).

The next question in the survey was about how important water is to each participant. Both the Meadowlands and Florida participants agreed that water is essential for their lives. Figure 8 indicates the results. However, a limited number indicated respectively that water is reasonably important and less important to them. It is interesting to note that a group of participants between the ages of 18 and 20 years of age stated respectively that water is reasonably important and less important for them. This provides some insight into the reasons behind their perceptions since they do not generally pay for the water they use, since they are either away from home in tertiary institutions or they are staying at home and are unemployed.

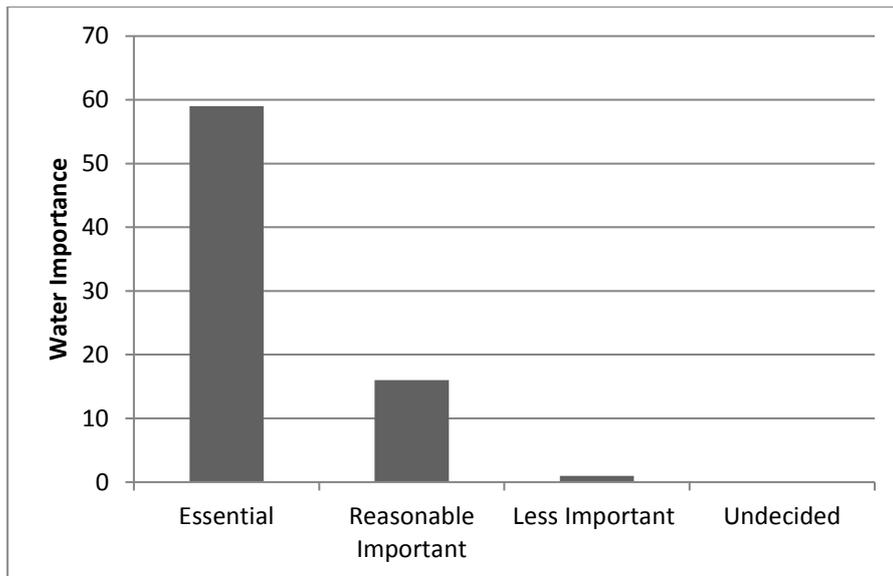


Figure 8: The importance of water as perceived by the respondents in both Meadowlands and Florida

Of the 53% (Figure 9) of households who pay for the water that they use in their homes in Meadowlands, only 5% are males as opposed to the 48% who are females. Twenty-seven percent (27%) of the respondents do not pay for water 19% of which are males and 8% of which are females (figure 9). This result reveals that females are the ones who manage the water and who make sure that water bills are paid. The Florida respondents confirm this trend (but with slightly different percentages.) However, the fact remains that the females, rather than the men, are more concerned with the payment of the water bills.

About 66% of the respondents in Florida pay for their water as opposed to the 11% residents who do not pay. The proportion of respondents paying their water bills in Florida is higher than that for Meadowlands. Some households in Florida use water meters to determine the amount of water that they consume monthly whereas other households pay for stipulated amounts of water that they predict that they will use in terms of their budget every month (“pay-as-you-use”).

It was noted that some households in Meadowlands do not pay for water at all. This is because government pensioners in Meadowlands get free water as opposed to the elderly living in the more affluent suburb of Florida. The latter are generally better off financially and enjoy a higher standard of living than those living in Meadowlands. This can be explained in terms of the legacy of the Apartheid system that negatively affected the socio-economic background of the black population, causing the people to generally be financially and socially disadvantaged.

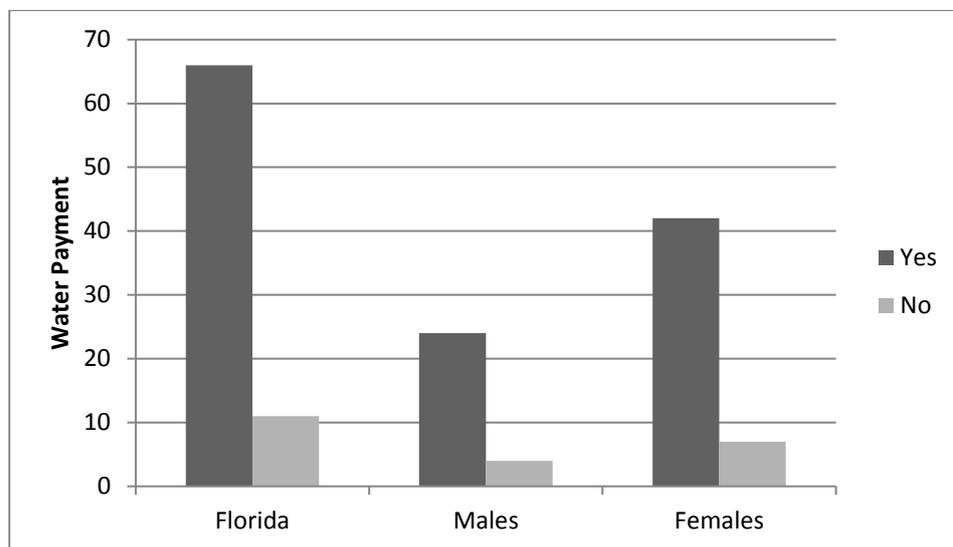
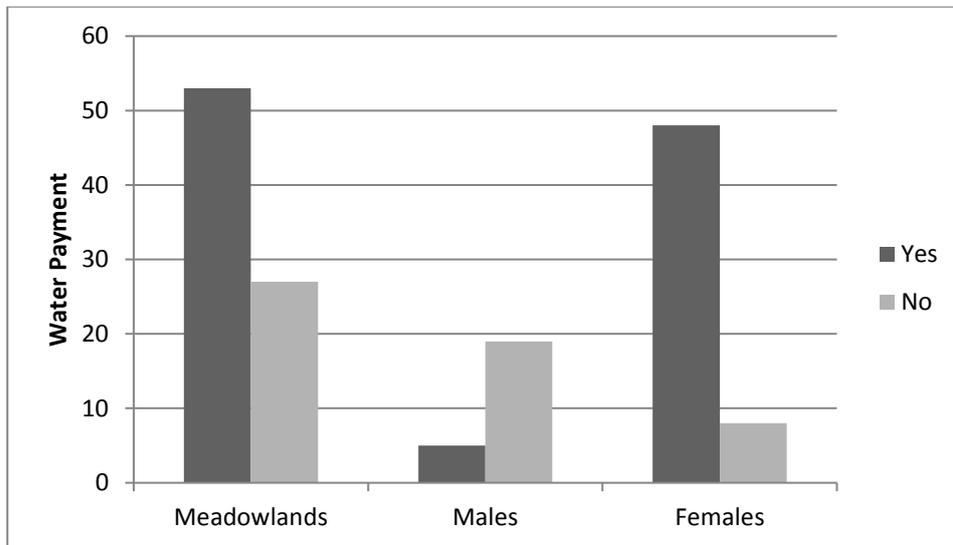


Figure 9: Water payment in Meadowlands (above) and Florida (left)

Some of the respondents in the Florida and Meadowlands households believe that water must be paid in terms of one’s employment, age and residential status. Those in Meadowlands who are living on government-subsidized or newly constructed houses are managing to pay for their water but the demands for water in this area are so great that they feel that their water needs are hardly being met. Most of the respondents in Florida do not mind paying for water as they regard their access to this vital resource as important.

The respondents from Meadowlands are divided in their notion of water issues and their responsibility of paying for water. They highlight the fact that older people are given free water on a monthly basis, while young working families pay for water monthly. Furthermore, those living in backyards and the surrounding

informal settlements and relying on communal stand pipes, do not pay for the water from the communal water points but access can be a potential problem.

One of the questions in the research questionnaire posed to those paying for water was how much they pay per month. Figure 10 shows that in Meadowlands, the majority of households (32%) pay less than R100 per month for water.

The general consensus is that in order to obtain water of a good quality the consumer must pay (Kelly, 2015). In Florida, only 5% pay less than R100 for their water per month. Not surprisingly though, in Florida, 12% of the households pay more than R550 per month for water.

The difference in this respect between Meadowlands and Florida is shown in Figure 10. In Meadowlands, females are responsible for paying for water, while in Florida; (Figure 11) it is mainly the males who pay the water bill. In Meadowlands, the majority are paying less than R100, while in Florida; the majority are paying more than R550.

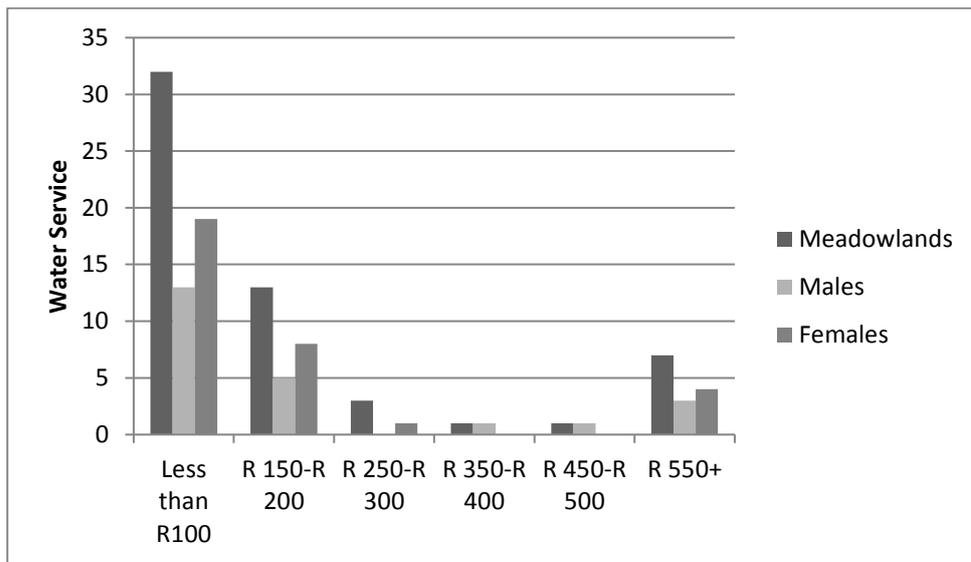


Figure 10: Water services paid by residents in Meadowlands

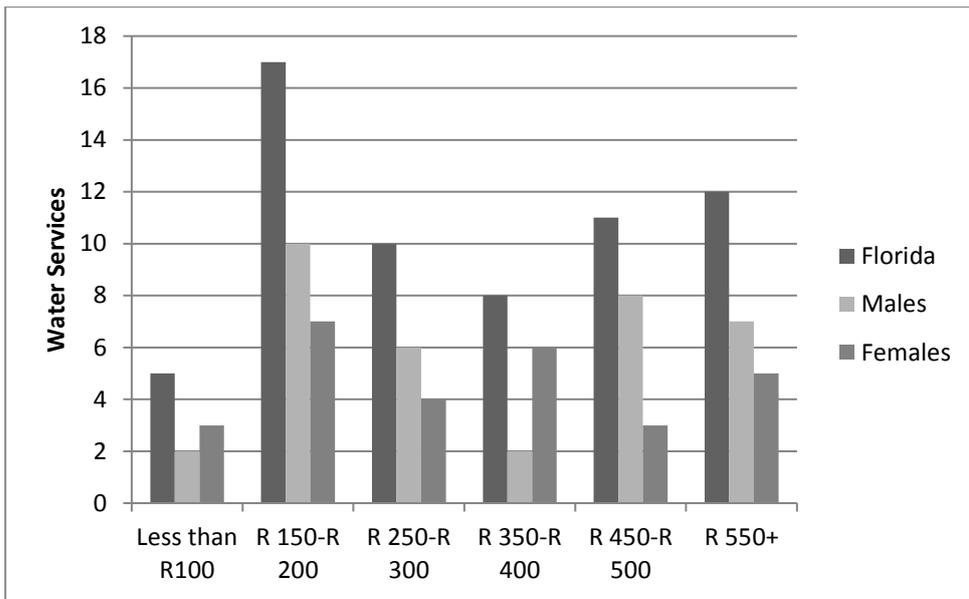


Figure 11: Water services paid by residents in Florida

Figure 12 indicates that around 60% of the households in Meadowlands are willing to pay less than R100 per month for water, with 20% of the males and 40% of the females showing their willingness to pay this amount. In Meadowlands, only 3% of the respondents indicated that they are willing to pay more than R550 per month for water. In fact, the respondents in Meadowlands regard water as a mandatory delivery service from and the responsibility of the municipality.

The statistics for Florida reveal different perspectives concerning payments for water. Twenty-five percent (25%) are willing to pay less than R100 for water per month, 11% of which are males and 14% of which are females. This small category is followed by a category amounting to 19% of the respondents to pay from R150 to R200 per month for water. Fourteen percent (14%) of the household respondents in Florida showed that they are willing to pay R250 to R300 for water while only 4% showed that they are willing to pay more than R550. Their ability/willingness to pay for water shows that the Florida respondents (representing the community) are taking water issues seriously.

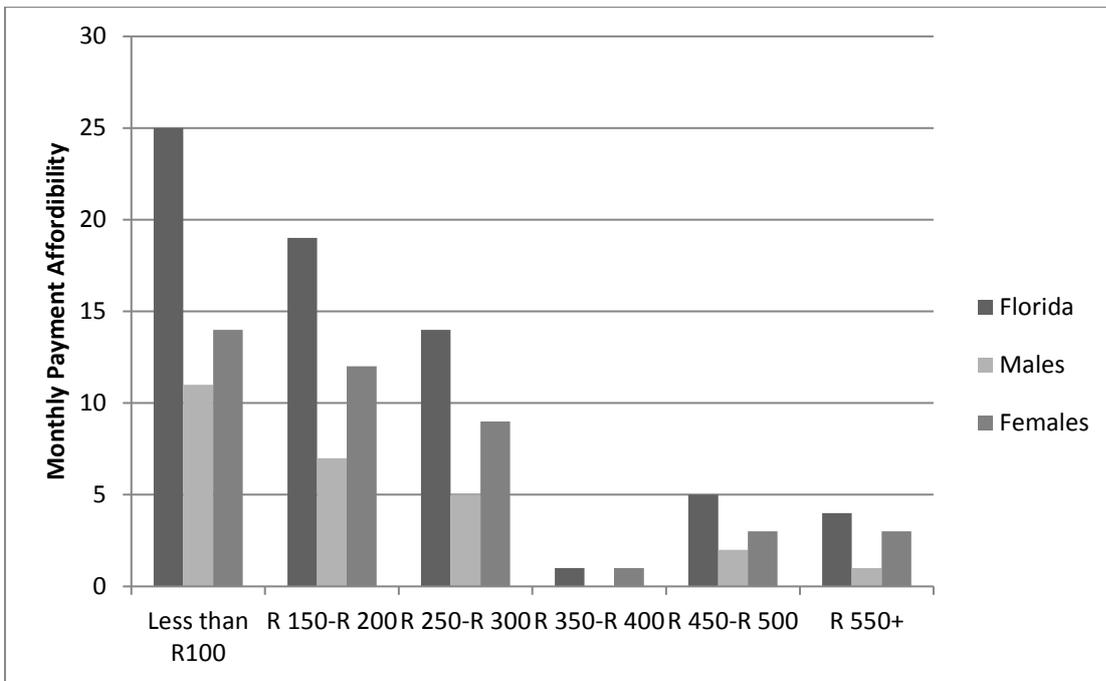
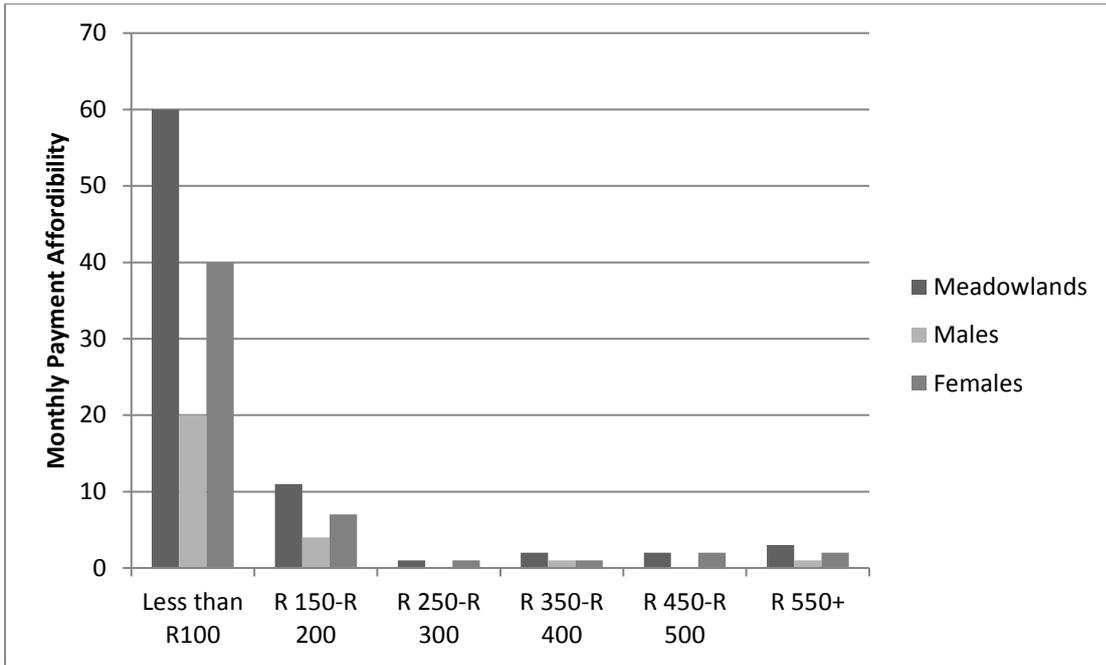


Figure 12: Monthly amounts per month that residents in Meadowlands (above) and Florida (bottom) are willing to pay for water

4.4 Water end-use

An analysis of the final use to which water is put (water end-use) is elaborated on in this section. Analysing the water and its role in communities and the way it affects them as the results of water conservation. Water end-use refers to the ways in which customers use water. This involves activities such as cooking, washing and bathing (Werner and Davidson, 2015).

4.4.1. Complaints about water

The respondents in both of the residential areas selected for this research complained about the stoppages or outages that sometimes occur in their water supply with occasional blockages which would remain unnoticed by the municipality. A key complaint that was raised by the female respondents was about the lack of consistency in the flow of water to their households. The fact that most of the complaints in both locations came from women was not surprising since women, rather than men, are more involved with indoor household activities. The research findings showed that Meadowlands uses water mainly for indoor tasks, which are generally the domain of the female.

Especially in Florida, the male respondents proved to be more concerned about using water in their outdoor tasks of washing cars and watering the garden and filtering the swimming pool water. The above-mentioned household activities indirectly reflect the differences between the two residential areas in terms of income.

4.4.2. Perceptions on water

100% people around Meadowlands use water for cooking and drinking purposes. They indicate that water is essential for their wellbeing and so for them, they want every-day access with others commenting that they must not pay for water because it is a vital resource in life essential for human existence and survival (Kossierris *et al* 2014).

In Meadowlands, because of the low monthly incomes and the high unemployment, residents view water as a free resource that no one needs to pay for. This confirms the notion that income and employment play a huge role when it comes to water usage and conservation (Naidoo and Constantinides, 2000). Males that are employed in both communities are not concerned much about water as opposed to their female counterparts. This researcher noted that the males who were interviewed during the research generally deferred to their females partners when it came to paying the water bills.

Regardless of whether the woman is working or not, results from the interviews found that they are the ones who are better informed about domestic water consumption and who pay the water bills in the family. This is because women, as opposed to men, are prominent in household duties such as cooking and cleaning. Florida residents use water for cooking, cleaning and washing but also for other household's uses such as watering the lawns and the garden, washing the car and bathing the pets (noted by Kossieris *et al*, 2014). Some believe that because they are paying for water, they can do whatever they please in using it unsparingly.

4.4.3. Access to water: who qualifies for free water Human Rights?

On this point, note that most of the members of a community pay for water. Some respondents argue that they should have access to water as it is stated in the South African Constitution that every citizen has the right to an accessible source of clean running water (see National Water Act no 36 of 1998).

4.5 Water conservation

Figure 13 reveals that more than 70% of the household respondents in Meadowlands acknowledged that they conserve water in different areas, while 7% admitted that they do not conserve water. The graph is in percentage, it based on the data collected. This large proportion of respondents in favour of conserving water confirms the findings of the researchers Inman and Jeffrey (2007). Both communities believe that as a result of the consequences of climate change, water must be conserved or managed because of its scarcity (Ziervogel *et al*, 2010).

About 7% of the male and 66% of the female respondents in Meadowlands indicated that they conserve water. This again shows that females are more sympathetic to water issues than males some of the elderly, especially in Meadowlands take it as the norm to practice water conservation. Having come from the rural areas initially, they indicated that they are familiar with various practices of water conservation such as water harvesting during the rainy season.

An interesting point to note is that most of the adults older than 30 years were most concerned about the usage and conservation of water in their households. Some of the older respondents believe that the government or the municipality should introduce a hike in the price of water so that communities will be more cautious in the usage and wastage of water (Waller and Scott, 2013).

Figure 13 shows that of the total number of participants that were interviewed about water conservation in Florida, 59% indicated that they conserve water, while 15% indicated that they do not. As against the 11% of males practicing water conservation methods, 48% of the females admitted to conserving water. Based on the data collected, the residents conserve water. The percentage was made to compare gender and areas on different perspective of water conservation.

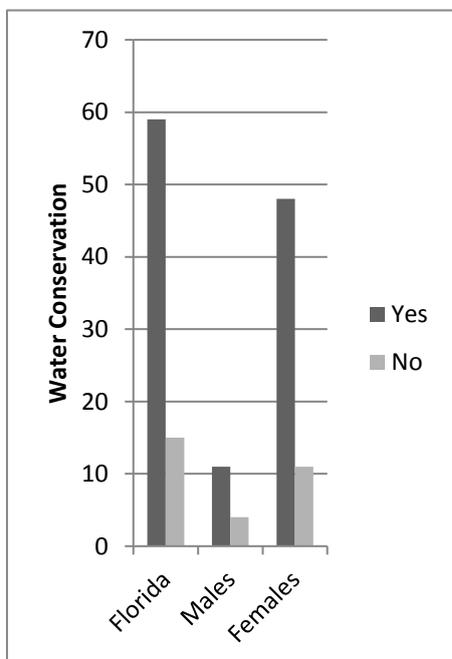
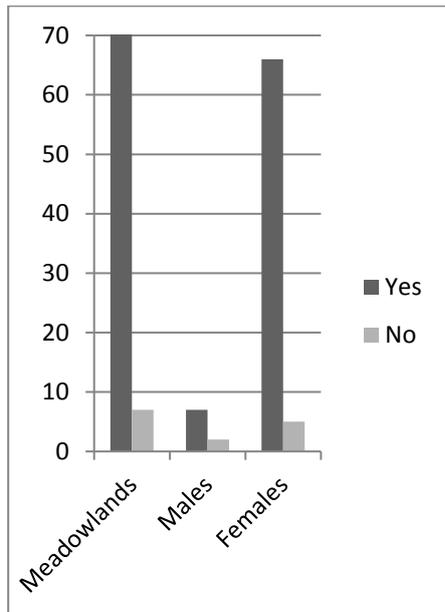


Figure 13: Water conservation in Meadowlands (above) and Florida (bottom)

Some thought-provoking comments were made during the interview process. In Florida, the respondents noted that their attitude to water conservation is

motivated by climate change, the unpredictable provision of water to them from the local municipality, and the high cost of water. Some respondents believe that water is a precious resource and needs to be protected, and are actively practicing recycling and re-use as water conservation methods (Beekman, 2010).

A number of households have water meters in their homes, but prefer to go the extra mile to conserve water not only by relying on the water meter, but by following water conservation tips or even programmes that remind them to continually gauge the amount of water that they are using.

Some of the residents in Meadowlands and Florida use water storage tanks (such as the commonly-known Jojo tanks) to collect rain water (Muller, 2008). Especially in Florida, this water is used for outdoor water requirements such as the:

- watering of the garden in winter ,
- filling of the pool in summer
- washing of their cars
- cleaning of the house
- flushing of the toilet and
- laundering of their soiled washing

Only the water from inside taps, etc. is used for cooking, washing, showering and bathing purposes. A few of these respondents also buy bottled water from the supermarkets and do not rely only on municipal water.

4.6 Water Rating in Meadowlands and Florida

4.6.1 The provision of water is the most important service rendered by the municipality

Many different opinions were recorded from a scale presented to the research respondents in the Meadowlands and Florida communities indicating household perceptions about water services by the municipality and the value they attach to them. According to Figure 14, only 51% of the Meadowlands respondents strongly agreed (15% males and 36% females) that they regard water delivery as the most important service rendered by the municipality, while only 3% strongly disagreed (Hordijk *et al*, 2014)

In Florida, residents were asked the same question. According to Figure 14, more than 46% of the respondents strongly agreed, with 15% male and 31%

females indicating the above. Like Meadowlands, only 3% of the respondents from Florida strongly disagreed that they regard water as the most important service rendered by the municipality. Those who disagreed mentioned that they are losing faith in the municipality in terms of water provision because, at times, they do not get the water they are paying for and receive no notification of when there will be a water cut.

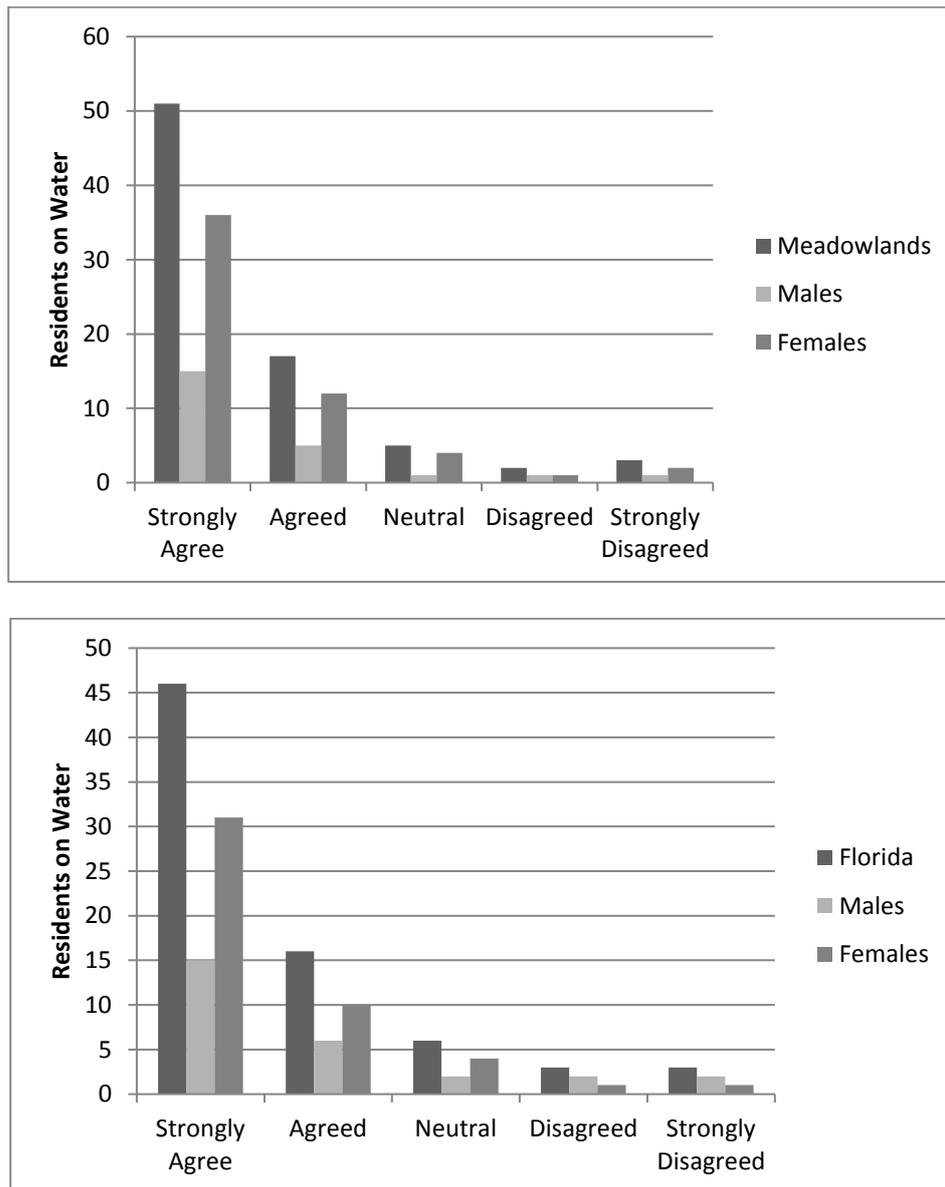


Figure 14: The opinions of the Meadowlands(above) and Florida(bottom) respondents regarding water as the most important service rendered by the municipality

4.6.2 Willingness to pay more in order to gain access to water

Figure 15 presents the willingness of households to pay more in order to gain adequate access to water. The majority of the Meadowlands households proved

to be neutral with regard to this issue, with only 12% being willing to pay less than R2 000 or more for an improved water service delivery. In essence, some of the Meadowlands respondents expressed their concern over water issues but they do believe that they should pay more for water if they can and as long as they do finally get access to a reliable supply of water.

The respondents from the Florida households strongly agreed that they would be prepared to pay up to R2 500 more per month for water. To pay the highest amount of R4 500 and above in most households was regarded as an exorbitant amount to pay for water usage.

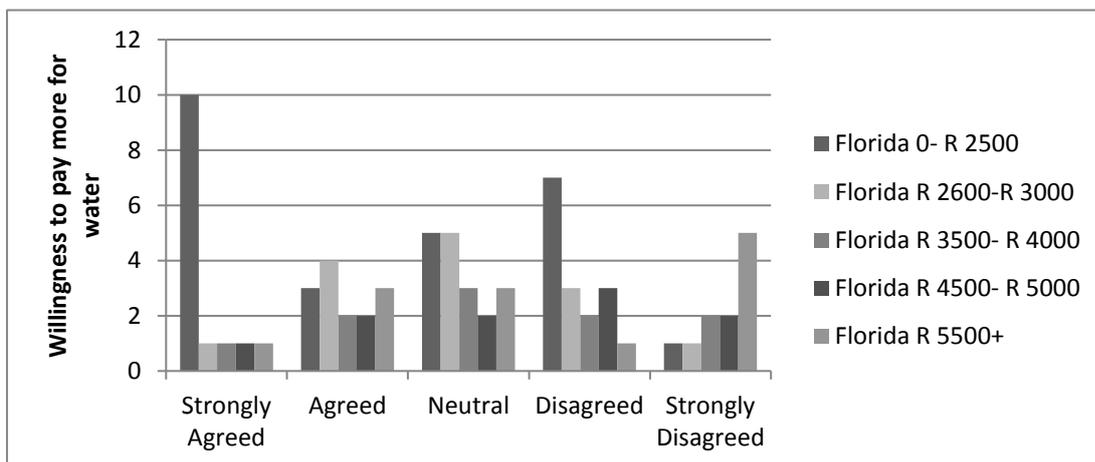
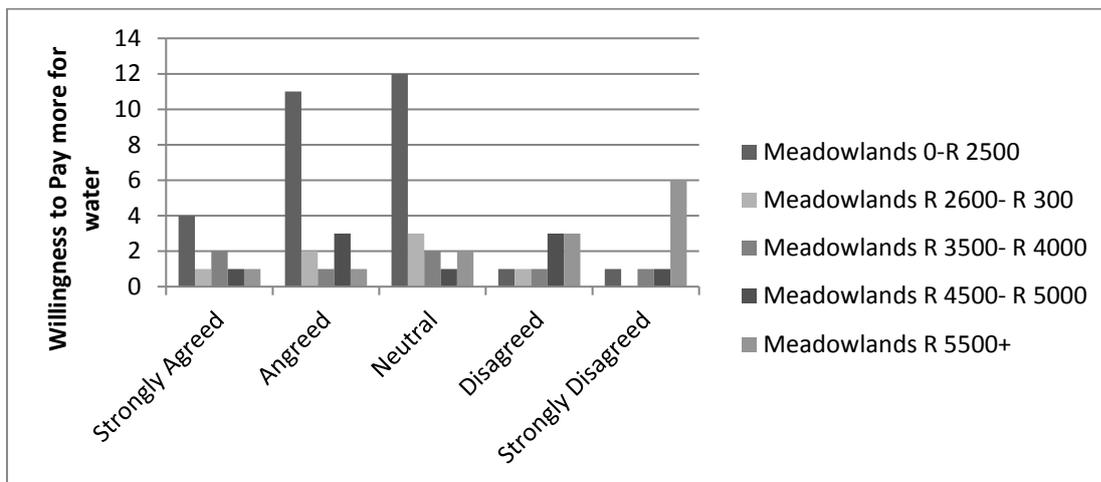


Figure 15: Level of willingness to pay more in order to gain access to water Meadowlands (above) and Florida (bottom)

4.6.3 Cannot afford to pay for water

The respondents who cannot afford to pay for water were asked for their opinions on the affordability aspect. Most of the respondents believe that water is

a natural resource and must be used without any penalties. On the other hand, others believe that consumers need to pay for water since there are costs involved, especially in its purification. The latter reference implies that people have a conscience when it comes to the exploitation of water for the benefit of humankind. Some believe that in order to supply clean water and to encourage people to conserve water, the consumer must pay for every drop that he/she uses (Domene and Sauri, 2006).

According to Figure 16, the majority of Meadowlands respondents (31%) took a neutral stance on the question. Most of the respondents indicated their neutrality by supporting any decision that would be applied by the water authorities on water conservation strategies.

There was a similar reaction in the Florida respondents with 25% of them being neutral on this question (Figure 16). The small number who “strongly agreed” to consider paying higher prices for improvements in the water service shows that certain people are willing to pay as long as they gain access to a more reliable water service.

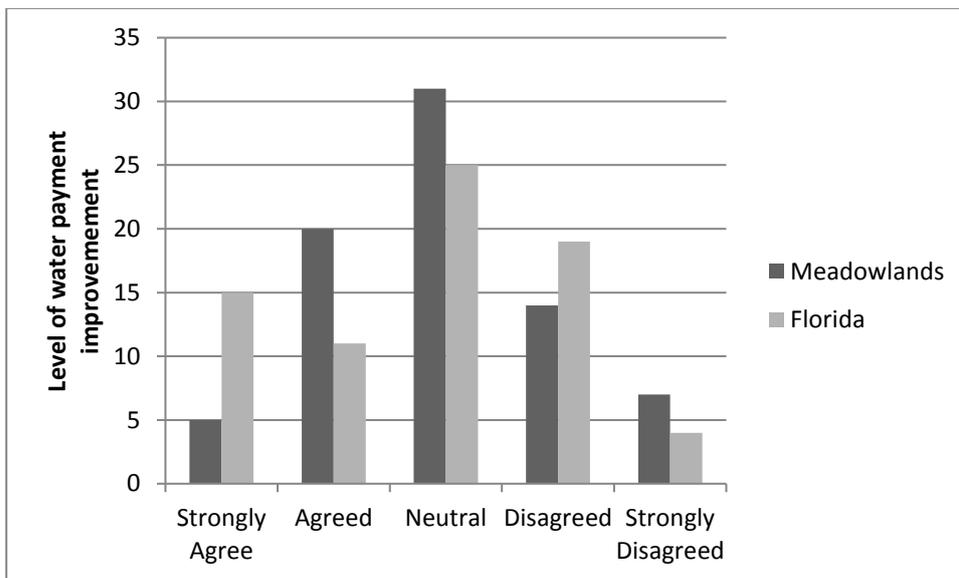


Figure 16: Level of willingness to pay for improvements in the water service

4.7 Conclusion

The objective of this chapter was to reflect on the analysis of the relevant data and to investigate the ways in which water conservation methods are practised under different socio-economic conditions. This chapter presents both change and continuity in terms of practice and experience.

This chapter began by exploring those aspects which indicate that the main aspect of water does in some way depart from the social backgrounds of the respective communities. The next chapter, Chapter 5, discusses the different components of the relationship between humans and water, looking from the Meadowlands and Florida results (within the context of South Africa) compared to other countries and different strategies that might be effective in the management of water.

Chapter Five

Discussion

5.1 Introduction

This chapter focuses on a framework for studying water conservation in the context of the socio-economic background of the communities in the two selected areas. Drawing on insights from the respective historical backgrounds of the two residential areas and the activities of the authorities and the respective residents in terms of water management, this chapter explores the ways in which knowledge pertaining to water conservation is gathered and assessed by the relevant actors in Meadowlands and Florida in the context of social issues such as gender, income and water usage.

Based on the findings of the previous chapter, the main aim of this chapter is to critically compare and evaluate the perceptions of the residents of selected households in the urban settlements of Meadowlands and Florida concerning methods of water usage and conservation. This discussion then assess their behaviour in terms of water consumption and conservation in the context of their respective socio-economic classes. Since the context is power-laden, the discursive approach is employed as an effective method to explore the associated dynamics between the different stakeholders.

This thesis does not concern itself with what the “correct” understanding of water conservation is or with what the methods of water conservation are, nor does it become preoccupied with any related operations/activities in respect of water. Instead, it focuses on the perceptions concerning water conservation of respondents from different socio-economic backgrounds, how these residents have come to these particular understandings, and ultimately, the implications of the identified perceptions/understanding in the context of water conservation.

The approach employed in this part of the study is inspired by various scholars in the field such as Inman and Jeffrey (2007) , Williams and Thomas, (2009) , Kossieris *et al* (2014) and Kelly (2015), and to name but a few. Their work investigates the links between households and their attitudes and actions with respect to water usage and conservation in the context of their social framework.

Researchers of water conservation such as, Van Tonder, (1999), Bawa, (2011) Nnadozie, (2013), Roy *et al*, (2013), and) and others, have come to increasingly value the significance of discourse analysis as a method to employ for a better understanding of the interfaces between water use, conservation and society (Lotti, 1992).

Various approaches to water conservation are based on a variety of basic assumptions about the world, nature and the human-nature relationship. These assumptions are more often implicitly hidden in practices and discourses than explicitly accounted for in discussions on water conservation.

It has become increasingly important to be aware of the various types of human-nature relationships that exist. These relationships define the way water conservation practices are envisioned and produced. The human-nature relationship expresses and can influence certain international and national policies, as well as management styles within the arena of conservation. These conservation practices can cost government or communities huge sums of money but sometimes they appear to be quite reasonable, especially when households understand the value and importance of water and set out to achieve the same good cause (Birch and MacLock, 2013).

5.2 Water in South Africa and water trends internationally

According to Gil and Barr (2006), the demand for water is increasing all over the world as a result of population growth. This highlights the importance of water to countries, but the key question is how these countries conserve water and make it sustainable? Research conducted by Lotti (1992) found that internationally, both the developed and developing countries will have to face the challenge of water conservation. Countries in Europe use chemicals as a method of purifying water as part of their water conservation programmes (Biagi and Ferro, 2011; Zietlow *et al*, 2016) Such chemicals are expensive so that their governments need to be involved in establishing more water purification plants in all regions. Water purification is where chemicals are used to recycle water or re use. In Meadowlands and Florida residents they don't have much information or skill on water purification process. This doesn't only happen in study are but all over developing countries there is a shortage of skill in water purification from water authorities to citizens.

Waller and Scott (2013) proposed certain water conservation methods in Canada that would include the water consumers as part of the conservation programme.

The water authorities task would be to encourage communities and municipalities to work together to conserve water. The main goal of the Canadian municipalities in terms of water conservation has been to ensure that communities are aware about the wastage of water and to encourage members of the community to be concerned about the issue and to act accordingly (Waller and Scott, 2013).

Woltemade and Fuelhart (2013), who conducted research in Pennsylvania, (USA), believe that the placing of water meters in households is effective in promoting water conservation in that these devices send feedback to the consumers regarding the amount of water used and thus remind them to use water carefully. It is mainly in the countries in the Global North (e.g. Canada), where urban residents are provided with water meters as part of a water regulation programme which causes households to be cautious in their usage of water (Domene and Sauri, 2006; Waller and Scott, 2013).

The formation of three groups analysed by Toteng, (2008) in Botswana government of stake holders merges:

- dominant,
- discretionary and
- dormant stakeholders

Some of the countries on the African continent that generally suffer from water shortages would benefit from the implementation of structured NGOs or community involvement on water issues as they are main water consumers could play a role in assisting local communities to interact with the water authorities in conserving water (Toteng, 2008; Spronk, 2010).

South Africa, for one, has policies and laws in place for a national water conservation strategy, but the challenge is at ground roots level, where households must be educated as responsible consumers of water. Van Tonder (1999) and Nnadozie (2013) found out that with the demise of the Apartheid era in South Africa, the new democratically-elected government introduced new policies, committing itself to the delivery of water, as a human right, to all the citizens of South Africa. The policies are in fact in place for the authorities to implement and to deliver water to the people. The former Department of Water Affairs and Forestry (DWAFF) was given the responsibility of ensuring that all South Africans would then be given universal access to basic water services.

However, based on the research done by Nnadozie (2013) about access to water services in the post-Apartheid era, South Africa is still grappling with the problem of distributing water on a national scale so that every citizen can have access to clean drinking water. As such, all the country's energies have gone into that avenue rather than into addressing conservation measures.

This term "water conservation" is nevertheless a very real challenge to the government of South Africa, especially since 1994, since it needs to educate the public in this respect, as most people do not understand what it means. Nor do they understand the methods for implementing it.

5.3 Water conservation understanding

5.3.1 Gender

The relationship between gender and water is no strange phenomenon, especially in rural communities all over the world and in impoverished enclaves in urban areas since the acquisition of water at the consumer level is delegated to women (Behailu *et al*, 2015; Werner and Davison, 2015). The study find that women were found to be more prominent in water issues in Meadowlands and Florida since, especially in African communities, they are the main users and managers of water (Oyama *et al*, 2012).

Globally, women have played a key role in sustaining local communities through running water projects. As such, based on the larger proportion of them involved in water planning schemes, it would be wise to recommend that women be guaranteed leadership positions (Jones *et al*, 2004). Because the women have taken the lead in water affairs, the men have little knowledge of this aspect of the domestic scene. As a result, some of the male respondents in this research project were not willing to be interviewed on account of their perceived (and actual) ignorance about domestic water issues.

According to this researcher, water conservation research as a formal concept was introduced for the first time to the Meadowlands and Florida households through this study. However, a vast majority of the participants indicated that water conservation programmes were already being practiced in their households regardless of whether the residents were employed or not.

This research found that most of the households are run by females in both Meadowlands and Florida. They are the ones who are concerned about or pro-actively engage in water conservation matters such as make it sure there is no

leaking taps inside the house. This confirms work by the previously stated researchers such as Thomson *et al* (2009) and Kelly (2015); Xiong (*et al*, 2016) and Massoud (*et al*, 2013) found that when it comes to indoor household activities, the women are more prominent than the men in managing household water usage, the associated consumption levels and payments.

Age also appears to play a role as most of those respondents of 50 years and older indicated that they understand water issues and the importance of its conservation. On the other hand, young people in their early twenties proved to be less aware. As noted in the previous chapter, older people in urban areas originated from more rural areas. They have a better understanding of issues such as water conservation than the younger generation. Furthermore, some of them are the ones paying the water bills which make them more sensitive to water wastage (Clark and Finley, 2007a; Inman and Jeffrey, 2007; Macfarlane, 2013).

5.3.2 Education

Education is a significant instrument for the development of nations, as it offers the population the information and the knowledge to understand and apply different ideas and technologies (Xiong *et al*, 2016). To provide knowledge to the public and to offer the appropriate education on water, technologies and management approaches - that are compulsory requirements for sustainable management the educational inputs should be delivered from the foundations level (Inman and Jeffrey, 2007).

This Research showed that in Meadowlands and Florida, there is a need for such education in the young adult age group as those in their early 20's are inexperienced and know little about the importance of water in and their families' lives. As mentioned, some believe that water issues are for household owners or working people. The normal avenues for conveying such education around water, namely the school and the family, appear to be lacking, especially in the urban areas. This contrasts the situation in countries such as China where education around water issues is applied as an important topic at grassroots level in the early years at school (Xiong *et al*, 2016).

In South Africa, older people, especially women, are better educated in water issues. Elders that were interviewed for this research project indicated that they didn't go to school to learn about methods to conserve water. However, they believe that it is their responsibility to conserve water for future use - regardless

of whether they are given free supplies or whether they pay for it. This argument comes from results found in the study.

On an educational level, in South Africa, findings reveal that young people who have finished school do not realise the importance of water supply and conservation. It is apparent that people learn about water challenges only when they are forced to pay large amounts of money for water to the municipality (Thompson *et al*, 2000; Oyama *et al* 2012).

An assessment of Florida and Meadowlands at close range reveals that only limited numbers of respondents regard water as a less important resource. Those in the 18 to 20 age group indicated that water is reasonably or less important to them. This begs the question as to how do you conserve something when you do not understand the concept (e.g. why are you conserving water)? The reason for the limited value that they place on water can perhaps be explained in terms of the different insights that they have in this respect since they do not pay for the water they use because they are in tertiary educational institutions or they are unemployed, not earning and staying at home. The situation mentioned above differs for other studies such as that of Xiong *et al*. (2016) who discovered that in China education on water issues is implemented in the lower school grades as a core topic for young students to allow them to understand water issues and encourage them to save water.

Other motivations encouraging people to conserve water include exposing them to campaigns about drought (Gulyani *et al*, 2005; Domene and Sauri, 2006; Oyama *et al*, 2012; Waller and Scott, 2013; Kossieris *et al* 2014). Others regard water conservation as the norm and practice it diligently since they learned such an approach from their elders and they value the environment. This was found to be the case, especially in Meadowlands, where some of the residents are from rural areas and they use water with caution regardless, of whether it is free or not.

The above point highlights an interesting finding: as many of the older respondents in township and former rural areas have been faced with poverty, it appears that there is a link between poverty and water conservation. Those with limited financial resources and employment are forced to conserve water in attempt to keep costs down and also exhibit greater appreciation for water as a resource. This is evident by some of the Meadowlands respondents who re-use water more frequently than those in Florida.

Gulyani *et al.*, (2005) and Oyama *et al.*, (2012) identified that African households also respect water because of the cultural value attached to it. As such, the conservation of water in Africa is part of the norm that is passed on through the generations. Hardoy *et al.* (2005) mentioned that attaching value to water is a norm that other families or government can also be taught. Thus, to regard water as a valuable resource does not have to be taught at school and can be done merely for the sake of respecting the environment or nature.

5.4 Reality of water resource and conservation

According to Tom *et al.* (2011) and Kossieris *et al.*, (2014), innovations such as water meters and efficient, water-saving household practices should be adopted by primary household end-users. Such devices/methods enable consumers to monitor and control, on a real-time basis, the water consumption of their household and also provide valuable information and feedback (Jones *et al.*, 2004 and Thompson *et al.*, 2000). At the same time, these devices and methods further support the end users, thus encouraging them to modify and improve their consumption profile through an interactive educational process that consists of a variety of online tools and applications. Tools such as a meter box are very useful in conserving water, especially if the service provider is measuring the water through it. The water meter box is one of the methods used to control the exploitation of a limited water supply (Zietlow *et al.*, 2016).

Some Meadowlands households are using water meters that are programmed by the municipality to manage their water consumption and to avoid the wastage of water. Some respondents in Florida conserve water by relying on rain water harvesting, by buying water from supermarkets, and by collecting water from boreholes.

Thompson *et al.*, (2000), Gulyani *et al.*, (2005), and Oyama *et al.*, (2012) and others have experience in researching water issues in developing countries in Africa. They found that generally in the poor urban areas of Africa (e.g. in Kenya), people buy water from kiosks. This highlights the essential nature of water in different communities regardless of their financial status – whether they are rich or poor. This leaves the question of who should pay more for water - the rich or the poor.

The bottom line is water is a vital resource as the results indicate that even households of low socio-economic status, especially in the Global South, pay for water since they need it for survival. This indicates that money plays less of a

role compared to the Kenya situation whereby people who are desperate for water are willing to pay to get it even though they are low class people of the country (Gulyani *et al* 2005; Thompson *et al*, 2000; Oyama *et al*, 2012).

The households in Meadowlands and Florida that conserve water do it for different reasons. This is a matter for concern considering that different social groups perceive and experience water usage and conservation in different ways, depending on the specific circumstances in which they find themselves (Coleman, 2009).

Massoud *et al* (2013), Spronk (2010), Toteng (2008) believe that water conservation practices are not just motivated by social practices and the economy. As environmental campaigns create awareness about droughts and floods as the results of climate change of which in Meadowlands and Florida there are households that are concerned about climate change that makes them use water efficiency .

Xiong (*et al*, 2016) sees the water distribution must be aligned with water conservation strategies and, activities such as irrigation, kitchen, bathroom, laundry and other domestic water utilities (especially in urban areas) are common water use activities in households regardless of social status. By stating this means water conservation is fundamental in many activities. This depends on specific households and its culture belief on water such as some households are pro-environmentalist (they like nature such as flowers and grass) in their homes they use water to watering plants.

Meadowlands and Florida resident's culture and perspective on water use and conservation practices are not the same. Water payment plays a huge role on these water conservation methods as mentioned early on. Some people wish to not pay for water as they believe it's a natural resource. This is reflected in the residents' areas use of water for cooking, washing etc. The main difference in these two areas is Florida utilizes more for outdoor activities such as lawn care, vehicle maintenance and bathing pets whereas people from Meadowlands are more concerned with more basic indoor activities such as cooking and bathing .

This confirms research by Waller and Scott (2013) and Werner and Davidson, (2015) who investigated the different use of water in different households in Canada and Australia. In households where socio-economic status is high, they use more water in outdoors activities such as watering garden and grass, filling swimming pool, cleaning pets and washing cars (see also Waller and Scott, 2013). These activities are exercised by people who believe that they pay enough for water and it's the water provider's duty to conserve and provide them with water because they pay more to access quality service. The above situation contrast with what Toteng (2008) finds in Botswana under the Water Utility Cooperation (WUC) which applies certain water regulations on water use for outdoor activities to limit water exploitation.

Sadalla *et al*, (2014) argues that people from suburbs focus on the distinct water usage within a home. They examined that it is not always the case that residential water use reflects residential priorities. From a consumer's perspective, water is used for multiple purposes in the home such as cooking, washing laundry, flushing toilets, watering lawn, and filling swimming pools. As results each of these purposes may be valued differently. Certain water uses may be less important "luxury" items that would be purchased only when extra funds are available.

In the predominantly more developed Florida study site, most households are cautious about water and acknowledge that is it needs to be conserved and used wisely. People in Florida are not relying only on the municipality for water provision and conservation. They practice re-use and recycle methods on water as part of water conservation. Many bathroom showers and toilets are installed with new technological devices that release limited water (Beall *et al*, 2000; von Schnitzler, 2008 Beekman, 2010). However global north countries, according to Werner *et al*, (2015), practiced the following measures to communities as part of water conserving especially in urban areas:

- Limiting landscapes irrigation to only one day a week during winter.
- Banning irrigation on permitted watering days between 10 a.m. and 6 p.m.
- Allowing cars to be washed only on permitted watering days.
- Forbidding car washing without a shutoff nozzle attached to the hose with fines underscores the important of water conservation.

Some of these practices can be applied to both areas of this study, it is not a challenge to practice such water conservation methods because most households don't own swimming pools and gardens as Waller and Scott, (2013) and Werner, (2015) found in Canada. Limiting landscape irrigation to only one day a week during winter (made a noticeable contribution to conservation). These can be implemented in some households that having swimming pools especially in Florida as part of water conservation. As mentioned, Meadowlands does not make much use of water for outdoor activities. In contrast, Meadowlands might allow cars to be washed only in designated car wash businesses and forbidding car washing without a shutoff nozzle attached to the hose with. The use of fines and penalties may underscore the important of water conservation (Beall *et al*, 2000; Gilbertson *et al*, 2011; Sauri, 2013).

Burgin and Webb (2011) argue that effectiveness of water conservation rests with compliances at the level of the consumer or household. In the case of individuals in households, this means that not only must they be aware of the water conservation needs, they must also identify the behaviour changes necessary to conserve water usage (Syme *et al*, 2000; Coleman, 2009). The creation of effective water conservation programs must not only target specific water conservation behaviours but also provide informative, meaningful feedback resulting from behavioural changes (Gilbertson *et al*, 2011; Tom *et al*, 2011).

The increasing demand of residential water in Meadowlands and Florida makes the focus of water conservation is unlikely. As Clark and Finley (2008b), question how one can conserve something when they even never have enough of it to distribute? Scholars such as Thompson *et al*, (2000), Gulyani *et al*, (2005) and Oyama *et al*, (2012) and) note that in African water context, focus tends more towards water distribution or provision instead than on conservation.

The change of local residents' perception on water might have some effects on the matter. Birch and MacLock (2013) determined that community education initiatives might be the first step in building awareness and changing attitudes of the residents. According to Oyama *et al* (2012) there is an association between the average educational level of a community and the knowledge that its members generally hold with regard to water conservation, which in turn influences their behaviour in respect of water. At Meadowlands, the elder respondents noted that they taught their younger generation on water conservation as they were taught in earlier times.

Rainwater tanks provide an avenue for local water supply to be under the ownership and control of the household. However, both communities notify that in winter times where there is a shortage of rainfall, the water tanks become unused. Meaning they are productive only in summer rainy seasons. Garcia, *et al*, (2013) believe that water tanks are becoming a useful opportunity when comes to seasons especially in rural areas.

Water tanks are useful to conserve water as the only alternative to get and store water for future use. Referring to Meadowlands and Florida, water tanks might be a solution to water conservation (especially rain water) how ever there are threats such as climate change and water pollution, highlighting that water tanks are not the main solution on the matter but part of it. By using rain water its part of water conservation. To buy water is part of conservation because you will use water wise since you put money in it.

Understanding water consumption in different backgrounds and context can be used to support other householders to better understand the water consumption profile of their household (Ilha *et al*, 2009). The residents know that it's their human rights to have access to fresh water as a source of life. In order to make water resource accessible to locals needs, South Africa's new water law, the National Water Act (no. 36 of 998), is based on policy of decentralization, distribution and participation (Sherwill *et al*, 2007). The feedback from various households in both Meadowlands and Florida indicates that they are aware on the water issue. Some used electronic devices such as modern washing machines as part of water conservation (Garcia *et al*, 2013). Thus was noted by some participants who teach their children at home to use water accordingly and responsibly.

A very interesting idea used by an elder woman in Meadowlands to save water, who lives with five grandchildren, successfully gets the five of them to use the same water to bath. To her, this method forms part of her monthly planning to manage water around household. Other households keep water in their buckets to avoid use of water taps (see Spronk, 2010). Majority of households in Meadowlands did not complain about money or level of income as a reason behind for them preventing them from conserving water (Clark and Finley, 2007a). They can conserve water in their way without the intervening of water authorities such as water municipality with water meters (Inman and Jeffrey, 2007; Kossieris *at al*, 2014).

Another point that was highlighted is bathroom devices that are installed by some of residents as part of water conservation (Waller and Scott, 2013). The water devices such as Low Flow Faucet Aerators (LFFA) used on showers and toilets played huge role in water conservation as it limits the volume of running water. Florida residents also noted that they limit bathing and shower time to ten minutes. To water the lawn the garden, flushing the toilets and wash the car is the part of water conservation used by several Florida residents (Thompson *et al* 2000). Some residents prefer to send car to car wash to avoid their water exploitation because it is perceived as cheaper and an approach to conserving their water (directly and indirectly).

As part of water conservation in Florida, some residents are purchasing water from supermarkets (Gulyani *et al*, 2005). They prefer to buy water because they will understand how valuable it is for their families to use it wisely. Some families have learned how to fix burst pipes as part of water conservation. There were complaints that water authorities took some time to come and fix pipes with hundreds of liters of water having being lost (Woltemade and Fuellhart, 2013).

Meadowlands household data indicates that water scarcity and household consumption has received increasing attention on national public agendas in recent years, this confirms work by Woltemade and Fuellhart, (2013) as well as Beall and Fox, (2009). Some families state that to save water is a norm in their household, they learned from early childhood that they must save water (Clark and Finley, 2008b). Then they pass that philosophy to their generation. As results less than 3% households in Meadowlands practice lawn watering. They believe that water must accommodate what is important for their daily lives (household needs). Such are the water conservation methods highlighted by the respondents.

5.5 Water perception in Florida and Meadowlands

According to water research scholars such as Gilbertson *et al* (2011), Tom *et al* (2011), Clark and Finley (2007a) and Tumbare (2015), people see water as important for living. As mentioned before that most countries try to minimise the exploitation of water. In Meadowlands and Florida, residents all agree that they need water and there must be some strategies in government to enforce people to think or do some positive actions on water conservation. In this matter of perception and attitude, with reference to Syme *et al*, (2000), it's challenging to understand people's attitude in water aspects. As the researchers emphasise it

is not easy to change household practices and the choices in water use and conservation.

Some of insights households that have were discovered by Coleman (2009), Pott *et al* (2009), Goldin (2010), Bakker (2013), Chetty and Luiz (2014) is that the more money that people earn the greater the advantage they enjoy in consuming large quantities of water, especial in terms of outdoor facilities such as swimming pool and gardens. In this Meadowlands and Florida case study, few households owns the swimming pools. A contrasting situation in Florida with what has been noted above, households in Florida are cautious on owning swimming pools, few households use swimming pools, and some preferred to go to public swimming pools as part of conserving water (Syme *et al*, 2000). In Meadowlands, not even one household interviewed owns the swimming pools.

Attitudes pertaining to personal and public responsibility and behaviour regarding water associated with these knowledge levels in some communities are different. Cockerill *et al* (2015) on his research in Georgia (USA) found that communities believed that industries and agriculture contribute more to water consumption problems than individuals. This shifts the blame from households as large water consumers comparing industries, as Georgia state water authorities provide business sectors huge quantity of water wheby residential households get less quantity of water. Georgia residents supported water using prices as a symbol of positive attitudes on water conservation as a commodity that needs to be protected (Cockerill *et al*, 2015), a sentiment shared by residents in Florida were supportive of paying for water as part of water conservation.

Education can change people's attitudes on water use and conservation, Xiong *et al* (2016) and Gilbertson *et al* (2011) agreed that droughts as part of climate change has some influence the way water is used and conserved. Gill *et al* (2009) agreed that awareness of climate change and politics was a significant factor in a person's intention to conserve water. This is highlighted in Bulgaria that the more aware and informed a person was about climate change and its impact, the more likely they were to implement water conservation measures in their own home. This can be better implemented in South Africa

5.6 Water conservation practice

Water education should also discuss the various water chemicals practices that purify water for future use, especially grey water (Beekman, 2010; von Schinitzler, 2008). As noted, water is a precious resource that requires

considerable chemical and technological (filtering) inputs to purify it for water consumption (Biagi and Ferro, 2011). Some developed countries of the world do not regard this as an insurmountable problem, and countries such as Germany and Spain are making great strides in this respect (Burgin and Webb, 2010). According to the interviews that were performed in Meadowlands and Florida, there are few households both areas that concern themselves with water purification as much as water recycling or reuse (Kucher, 2005). In Meadowlands, a majority were against paying high amounts of money for water, highlighting that they think water must be free with no chemical reactions taking place such as purification or used domestic water.

The recycling of used water can be considered as a renewable source as Sadalla *et al* (2014) indicated. The use of wastewater by households as non-potable uses in outdoor activities such as gardening represents a potential to be explored as viable substitute for treated and potable water especial if purifications chemicals are expensive for households to treat grey water (Beall *et al* 2000). New technology and chemicals such as membrane techniques are expensive because they required proper education with practical experience to households in order to use it in their water daily lives as part of water conservation (Smith and Hanson, 2003).

In terms of water conservation, some respondents would be able to use recommended chemicals to treat grey water, to purify harvested water or underground water as part of the process of accessing, storing and conserving water. Such a situation highlights the fact that as long as both communities have enough money to pay for it, they can access water, regardless of their backgrounds. The above information was found during the discussion with some of residents or participants during the research. They were showing that they are fully concern about water even though they cannot do anything about it.

The main challenge of water purification using chemicals requires that a particular level of education is necessary for the residents to understand how water can be purified through the application of chemicals. As a result, those who are better educated and who have enough money to buy the appropriate chemicals and can apply them, will be able to access potable water without government interference.

These proposals should consider the general water supply conditions and household demands of a community. Prevention is better than cure. River and

lake treatment as a source of water distribution sometimes is the better way to control water management. In a study by Pott *et al* (2009) determined that in South Africa, it is challenging to conserve water comparing with water demands from household to agriculture use along with industry and mining. South Africa has impressive policy; however enforcing them is a problem. In South Africa, the water purification of chemicals take place in rivers and dams where sources of water are stored and are distributed to communities (Gualitieri, 2007). This is a part of the role played by water authorities as a central point to conserve water for residents, as the results of high cost of these chemicals for household and to be able to provide it for them (Smith and Hanson, 2003).

In Meadowlands, households depended on municipality for water provision and they therefore may be a source for guidance on conservation and instituting the technologies and practices mentioned in this section. Involvement of the local government may also be a key possibility in promoting water conservation in the communities they serve. However, in the current context of Meadowlands and Florida, it seems that the best option to conserve water is to recycle and re-user water for indoor and outdoor activities.

5.7 Conclusion

This chapter has presented a discussion of the results of the analysis of the questionnaire. It highlighted the some techniques that can be used on water conservation and how can apply by residents. This chapter display some lack of experience especial in Meadowlands and Florida. Recommendations and conclusions for this study are presented in the following chapter.

Chapter Six

Conclusion

6.1 Introduction

The aim of this study is to critically compare and evaluate the methods of water conservation and understanding of water usage as perceived by residents of distinct socio-economic. A questionnaire was used as the main tool to achieve aim of the research. Water access, use and conservation are the key aspects that were investigated in understanding perspectives of water issues in the two study areas. The central concern was to explore how the households from two different areas are interacting with and experiencing water issues in terms of their current status, socio-economic class and different backgrounds, noting that they receive water from the same municipality. Water price and poverty are highlighted as key motives of water conservation and conscience.

The significance of this research lies in the fact that is one of the few studies to interrogate the social-economic construction of perception of water in a South African context. It also adds to previous international research that focus on the conservation of water in households . In this regard, the main focus is on household's relationship with water, in Meadowlands and Florida, regardless of how they access it. Water is one of the precious resource and water conservation or management in populated urban areas such as zones around Johannesburg is important. The study explores to what extent water is a priority in South African households and how fellow South Africans are thinking of it. This study notes is a link between government authorities and communities through policy.

The recommendations provided towards the end of the chapter make some suggestions with regards to rethinking water conservation in different households, regardless of class status of less and more wealthy. This chapter concludes with suggestions on the direction for future research studies of this nature, and in the discipline of Human and Physical geography in general. First the findings of the study are briefly reviewed.

6.2 Conflicting discourses of water conservation

This study analyse interacting between human and nature by exploring the different methods of water conservation based on different backgrounds. A key aim was to critically compare and evaluate the methods of water conservation and understanding of water use as perceived by residents of different socio-economic groups and explore difference discourses in water conservation as they are understood, in Meadowlands and Florida community. These understandings were termed 'discourses' in order to locate them within social realities, so that a clear understanding could emerge regarding the relations between the different actors and how this may impact on the potential for meaningful in water conservation context.

A number of research participants understood the nature of water conservation both areas, some they are unclear regarding the term but with actions and willingness towards water saving as part of water conservation. The discourse that water conservation is just another word for nature conservation is widely shared among actors in natural science and is perhaps the idea that has the greatest traction across the whole variety of respondents. Many of the respondents thought that the word water conservation relates to specific to certain programme that is operated by government, i.e. that it is not a 'must' for community responsibility or the individual household. What is interesting in the findings of the current study, however, is that it is not only the water authorities or scientists who must do something in the leadership structures of water issues but community too regardless of background they need water and they must protect water. However, while the majority both of communities subscribes to this particular view of water conservation, the rest of the community members generally do not.

There is an apparent finding that, as noted, poverty is a key driver of water conservation, particularly in the Meadowlands area. This study suggests that income, economic security, employment and education directly and indirectly play a role in water conservation in the following ways: affluence that comes from job security and stable income (resulting generally from good education) allows people to afford more water, however this is associated with greater water wastage/misuse as some respondents note that they are paying for the water and therefore can use as they want (Gualitieri, 2007).

Alternatively, those that rely on external taps and sources of water, and who have been exposed to poorer conditions (resulting from lower education levels and limited employment opportunities) are more likely to engage in water conservation, not necessarily out of preserving the environment, but to maximise water available to them and the cost (in terms of time, money and energy) of getting it by using water containers . However while the majority of both cases, attaching monetary cost to water does create awareness of water usage and is a possible tool in promoting water conservation.

6.2.1 Addressing the research objectives

The data was collected to address the following research objectives:

- 1) The first research objective was to critically evaluate and compare the value that households belonging to distinct socio-economic groups attach to water. This was done through data collection and analyses with graphs, as comparing two historically different backgrounds residents on water access and priority. Both areas get water from Johannesburg municipality regardless of socio-economic. Majority of households treat water as precious resource regardless of economy status. Females dominated in both locations as they are more concern with water use in the home.
- 2) The second objective was to explore methods used by both communities respectively to access water and to analyse the actions they have taken in order to conserve water to make it sustainable. The results were led by households especially females who are conserving water in both areas. Meadowlands practiced more recycling and reusing of indoor water for outdoors activities. Most notable is that people are indeed aware about water as a most important resource that needs them to look after it. Poorer people and communities are sensitive to price and so are more likely to conserve. This was found by using the questionnaire and have some discussion with the interviews on strategies they use on water conservation methods in their homes.
- 3) The third objective was to assess and compare the impact of water usage on water conservation practices in the case of lower and higher income households. This was performed by exploring household income levels and asking what the most household activities that the water is used for every day. The majority of respondent's conserve water by reusing and re cycling indoors water used to outdoors activities this is a massive positive experience because it doesn't

require money to perform it. Water containers are part of resident's water conservation practice. Cooking, bathing and laundry were the main indoor activities that water used for in both locations regardless of level income. There were minority group of participants using water for outdoor activities such as swimming pool and garden maintenance when compared to indoor activities.

4) The fourth objective was to examine the challenges faced by residents in terms of the consumption of water and conservation practices. This objective was achieved by questioning residents based on main household activities and exploring what challenges and opportunities respondents faced in conserving water. Most participants were able to get access to water, regardless of economic socio background. On the part of water conservation practices, few households did not conserve water in both areas and socio-economic status was not a main reason on lack of water conservation (in some cases, the opposite was true). The biggest challenge was ignorance or lack of information about the important of water and how can the community initiate methods to conserve water without relying on water authorities..

This study explored human-nature relationships by identifying the different understandings of water conservation. Majority of households in both areas understand the value of water as a precious resource that needs to be protected. While other people they think its government or water authorities to conserve and distribute water. All these information was found on answers people they were providing in the questionnaire during the research interview.

A significant number of research respondents understood water conservation methods and approaches essentially as just another word for culture, as they bear in mind that water is important for their lives and it's their responsibility to preserve it. Many of the respondents thought that water conservation relates to everything that is associated with human rights, where water is a natural element that needs to be provided with or without someone's authority, i.e. "no one can make water but someone can clean or store water." What is interesting in the findings of the current study, however, it that is not only the scientists or policy implementation that can conserve water but also community individuals (regardless of age, gender, education, income) such as those of Meadowlands and Florida communities. However, this doesn't mean that whole community of Meadowlands and Florida conserve water or understand water conservation

perception in their daily lives. Gender showed bias as women are more prominent and aware with water issues compared to the males interviewed.

Several respondents espoused basic simple methods on their practical water conservation in their homes. Water conservation to others was about sustainable development or water insecurity. For those citing water sustainable development, conservation was about reusing and recycling water for other household activities. Those noting water insecurity commented that they are worried about South African weather situation (climate change) as main forcing them to change their water pattern. Many are conserving water because of water charges or bills. A large portion conserves water due to the fees associated with water access. There is a trend that people were more concerned with the cost of water than water conservation. It is noted that cost applied to water can promoted water conservation. These are some analyses are found on respondents is during the interviews.

A narrative interweaving of social income relationship and the protection of natural resources was also given significant expression. This reasoning derives from the realisation that sustainable conservation of natural resources cannot occur without the involvement of the communities who make use of the resources. In this sense, water conservation is understood to be inextricably linked to socio-economic development and other social activities such as money by considering rich people who can have an access of quality water anytime such extent that they can buy water while people with not much money they rely on rivers or rainwater. It is significant that the working participants who expressed this socio-natural environmental understanding of water conservation were largely open respondents during the interview. They were relating their financial situation with water accessibility and conservation. Nevertheless poor and rich both communities fully understand importance of water.

6.2.2 Recommendations

Some of the challenges faced by the households of Meadowlands and Florida is lack of information when comes to water management and also financial capacity constraints. In this regard, this thesis suggests that the Department of Environment Affairs and Department of Water and Sanitation should have a much more active role in teaching and mobilise different communities on the important of water conservation. People they can learn about the important of water conservation as pro-environmental being or sustainable development.

Metering (such as used in Canada) is a must for communities that want to decrease consumption. Without a user-pay system, water will continue to be wasted. In communities where metering was introduced as part of a water conservation initiative, reduction started as soon as the metering was implemented (Domene and Sauri, 2006). Such system could be instituted in Florida by the municipality and form part of a water conservation awareness initiative.

In order to overcome some of the governance challenges on assisting the communities, water authorities should seek to include a wide variety of interests in its meetings, and policy amendments (public participation) with communities. Such water conservation methods must include ward councillors, nongovernment organisations, scholars and schools. It is necessary to encourage and facilitate meaningful participation of these representative structures mentioned above. While a more inclusive engagement it has minimum risks on decision making as the negotiation about water policies is involving ordinary people who use water and listen their suggestions and solutions before proclamation policies. It has the advantage of enabling productive deliberation which can bring to the fore points of contention that may hinder good governance.

This thesis also recommends that water distribution must be similar regardless of background, those who exploit must be penalised more by provincial working along with provincial to a regional or local government. Water authorities should be more sensitive to the complexity of creating and sustaining community conservation initiatives. Only in this way, can the water conservation methods can deal with by central provider while encouraging users to conserve and rewards those who conserving water. This can be useful on conservation of the environment and improving urban livelihoods.

A provincial stewardship indaba where water providers from all over South Africa and international meet to discuss latest updates and technology on water conservation methods in big cities. Municipalities from different background meet with communities once a month to check water issues that people might concern about and updates to keep up with new developments. Participants can engage and share experiences would be advantageous in creating a community of practice. Such a gathering could also consider inviting prospective participants to attend. This would help in creating a platform for the mutual sharing of ideas in

water issues where the participants have similar interests and the sessions are accessible and are of interest to them.

Another aspect that might be used by communities is using water tanks during summer to store rainy water this can be a solution especial if government can interfere like Audtralian Government where is supporting communities with free tanks to sustain water. This kind of water in tanks can be used for washing laundry, cleaning the house, toilets and washing pets and cars. Rainy water can play huge role in substituting municipality water for outdoor activities. Government must support communities with these rainy tanks and encourage the residents the importance of tanks for their water.

6.2.3 Further Research

Based on the findings from this study, areas for further research include exploring perceptions of households on water conservation methods. Especially in South African urban areas where population is growing, communities are the people who used water and they need to come with their own solutions before water authorities' recommends water bill policy to them.

6.3 Conclusion

In this chapter, an overview of the entire chapter has given, covering all aspects of the research. Water conservation is crucial regardless of social backgrounds. Meadowlands communities some are not educated but they manage to conserve water. Others are unemployment but they manage to conserve water. Last but not least the study shown that household social and economic conditions necessarily limit people in conserving water and all relies on their perception with water. Anyone can conserve water and everyone needs it. In conclusion, notice is given to users of this document, that is should be read bearing in mind research focus and limitations.

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