Assessing the perceptions of consumers on wastewater reuse in the Vaal Triangle

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REMARKS

The reader is reminded of the following:

The editorial style as well as the references referred to in this dissertation follows the format prescribed by the NWU Referencing guide (2012). This practice is in line with the policy of the Programme in the Potchefstroom Business School to use the Harvard Style in all scientific documents.

ABSTRACT

Many countries, including South Africa, are facing the reality of insufficient water supplies to meet their present and future water demands due to decreasing freshwater availability and increasing demand. Increased populations and climate changes further exacerbate the problem. South Africa is considered the thirtieth driest country in the world with limited supplies of water which are unevenly distributed. Thus there is a need for alternative water sources to augment the freshwater supply. Wastewater reuse has been identified worldwide as a viable option to augment water supplies. While technologies are available to ensure proper treatment of wastewater to even potable standards, many countries have experienced public resistance to wastewater reuse due to negative perceptions of consumers. For wastewater reuse initiatives to be successful public acceptance is imperative.

The aim of this study was to assess perceptions of consumers in the Vaal Triangle on wastewater reuse. This is the first study conducted in the Vaal Triangle on wastewater reuse hence this information can be valuable in future when wastewater reuse projects are implemented

A questionnaire to measure perceptions of consumers on wastewater reuse was developed based on previous studies and distributed to people residing in the Vaal Triangle area. A response rate of 74% (515 completed questionnaires) was obtained from 700 distributed questionnaires. The results showed that socio-demographic factors such as age, race, qualification and level of employment affect the perceptions of consumers on wastewater reuse. Additionally, knowledge of wastewater reuse and water scarcity had a positive effect on consumer's perceptions. Some of the major reasons why consumers are not receptive to wastewater reuse are health concerns, lack of trust in the implementing agencies, poor management of the plants and safety of chemicals used to treat the water. Lack of knowledge on wastewater reuse was raised as a major concern in the study. All these concerns need to be addressed to ensure success of wastewater reuse projects within the area.

Limitations within the study were identified and recommendations for future research were made.

Key terms: wastewater, wastewater reuse, consumer perceptions, water scarcity

OPSOMMING

Baie lande, wat Suid-Afrika insluit, word gekonfronteer met die realiteit van onvoldoende waterbronne om die huidige en toekomstige waterbehoeftes van die land aan te spreek omdat varswatervoorrade verminder en behoefte vermeerder. Groeiende bevolkings en klimaatsverandering vererger die probleem nog meer. Suid-Afrika word beskou as die dertigste droogste land in die wêreld, met beperkte waterbronne wat boonop ongelyk versprei is. Dus is daar ‘n behoefte aan alternatiewe waterbronne om die varswaterbronne aan te vul. Afvalwater herverbruik is al wêreldwyd geïdentifiseer as ‘n werkbare opsie om watervoorrade aan te vul. Terwyl daar tegnologieë beskikbaar is om afvalwater tot drinkbare water skoon te maak, is daar in baie lande openbare weerstand ervaar teen die gebruik van afvalwater as gevolg van negatiewe persepsies aan die kant van verbruikers. Vir afvalwaterherverbruik inisiatiewe om te werk moet openbare aanvaarding gekry word.

Die doel van hierdie studie was om die persepsies van verbruikers in die Vaaldriehoek oor afvalwaterherverbruik te assesseer. Dit is die eerste studie van hierdie aard in die Vaaldriehoek oor afvalwater, dus is die inligting wat uit die studie verkry word van groot belang indien herverbruik van afvalwater oorweeg sou moet word.

‘n Vraelys om persepsies van verbruikers te meet in terme van die herverbruik van afvalwater is ontwikkel, en is gebaseer op vorige studies, en uitgedeel aan mense wat in die Vaaldriehoekgebied woon. ‘n Responskoers van 74% (515 voltooide vraelyste) is verkry uit die 700 uitgedeelde vraelyste. Die resultate het aangetoon dat sosiodemografiese faktore soos ouderdom, ras, kwalifikasie en vlak van werk die persepsies van verbruikers oor afvalwaterherverbruik beïnvloed. Sommige van die hoofredes waarom verbruikers nie ontvanklik is vir herverbruik van afvalwater nie berus op gesondheidskwessies, gebrek aan vertroue in die implementeringsliggame, swak bestuur van aanlegte en die veiligheid van chemikalieë wat gebriol word om die water te behandel. ‘n Gebrek aan kennis oor afvalwaterverbruik het as ‘n groot bron van kommer uit die studie geblyk. Al hierdie aangeleenthede moet aangespreek word om die sukses van projekte te doen met afvalwaterherverbruik te kan verseker.

Beperkinge in terme van die studie is uitgewys en aanbevelings is gemaak vir toekomstige navorsing.

Sleutelterme: afvalwater, afvalwaterherverbruik, verbruikers se persepsies, waterskaarste

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ABBREVIATIONS AND ACRONYMS

DWA	Department of Water Affairs
AMD	Acid Mine Drainage
IPR	Indirect Potable Reuse
DPR	Direct Potable Reuse
NWRS	National Water Resource Strategy
VRS	Vaal River System
WGD	Water Resource Group
WRC	Water Research Commission
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works
WfGD	Water for Growth and Development Framework

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

WATER REUSE TERMINOLOGY USED IN THE DOCUMENT

Water reuse: Utilisation of treated or untreated wastewater for a process other than the one that generated it, i.e. it involves a change of user for instance, the reuse of municipal wastewater for agricultural irrigation. Water reuse can be direct or indirect, intentional or unintentional, planned or unplanned, local, regional or national in terms of location, scale and significance. Water reuse may involve various kinds of treatment (or not) and the reclaimed water may be used for a variety of purposes.

Water recycling: Utilization of treated or untreated wastewater for the same process that generated it, i.e. it does not involve a change of user for instance, recycling effluents in a pulp and paper mill.

Direct reuse: Reuse of treated or untreated wastewater by directly transferring it from the site where it is produced to a different/separate facility for the next use.

Indirect reuse: Reuse of treated or untreated wastewater after it has been discharged into a natural surface water or groundwater body, from which water is taken for further use.

Planned or intentional reuse: Use of treated or untreated wastewater as part of a planned project. It is always performed intentionally, consciously and using reclaimed water for a specific user.

Unplanned or incidental reuse: Subsequent use of treated or untreated wastewater after it has been discharged into a surface water or groundwater body from which water is taken for drinking purposes or another use. Initially, it always occurs as a subconscious activity; with time it might occur consciously but not as part of a planned project in which wastewater is properly treated and water quality monitored for the specific water use purpose.

Reclaimed water: Wastewater that has been treated to a level that is suitable for sustainable and safe reuse.

Wastewater: Water derived from any of a number of uses of water and typically containing residual pollutants associated with the use of the water.

Wastewater treatment: This includes any process which may be used to favourably modify the characteristics of the wastewater.

Grey water: Wastewater derived from the domestic and household use of water for washing, laundry, cleaning, food preparation etc. Grey water does not contain faecal matter.

Potable water: Water intended to be used for drinking or domestic purposes.

Reclamation: Treatment of wastewater for reuse, including indirectly or directly as potable water.

Recycling: The reuse of wastewater, with or without different levels of treatment.

CHAPTER 1: CONTEXTUALISATION OF THE STUDY

1.1 INTRODUCTION

Water is essential for socio-economic development and for maintaining healthy ecosystems (World Bank, 2010; World Economic Forum, 2011). Properly managed water resources are a critical component of growth, poverty reduction and equity. The livelihoods of the poorest are critically associated with access to water services (World Bank, 2010; World Economic Forum, 2011; WHO, 2013).

Despite this, water security is a major challenge faced worldwide today. The World economic forum states that the world will face a 40% global shortfall between forecasted demand and supply by 2013 (World Economic Forum, 2011). In South Africa it is expected that a water supply and demand gap of 17% will emerge by 2030 as the demand for water is rising (NWRS2, 2013:2). Additionally, South Africa is considered the thirtieth driest country in the world and has limited supplies of water which are unevenly distributed (DWA, 2004:20; DWA, 2006:8; DWA, 2012:8; NWRS2, 2013:10; van Koppen *et al*., 2011:8). With a population growth of 2.4% per annum, it is expected that South Africa's water demand will likely exceed available water resources in selected areas within the short to medium term (van Niekerk & Schneider, 2013:2). Additionally, the demand for water does not correspond with the distribution of water (DWA, 2004:22; DWA, 2012:9; Ilemobade *et al*., 2013:351). As a result, most of the country's water supplies are stored in dams to overcome the uneven distribution of water resources. However, to date opportunities for developing new and economic dams to meet the growing water demand have been limited as most of the economically accessible yield from surface water resources has been fully developed and exploited (DWA, 2009:35; DWA, 2012:9; van Niekerk & Schneider, 2013:2). To combat water shortages, water conservation and demand management have been exploited by most countries, including South Africa, but proved not enough to close the water supply-demand gap, indicating a need for alternatives to augment water supply (Bixio *et al*.,

2006:89; DWA, 2009:35; Jhansi & Mishra, 2013:1; Marks 2006:137; Muller *et al*., 2009:5).

The National Water Resource Strategy (NWRS2, 2013:10) indicates that South Africa relies mainly on surface water. However, extensive reconciliation studies conducted by the Department of Water Affairs (DWA, 2006:7; DWA, 2007:8; DWA, 2008:13; DWA, 2011:2; van Niekerk & Schneider, 2013:2) indicate that surface water alone is not enough to support the growing needs of the economy, and this is an indication that South Africa needs to exploit alternative resources to meet growing water demands.

The Department of Water and Sanitation (DWS), formerly known as the Department of Water Affairs, the custodian of water resources in South Africa, has identified wastewater reuse as one of the options to augment water supplies (NSWR1, 2011:1; NSWR2, 2013:29; WRC, 2014:3). Studies (Adewumi *et al*., 2014:11; Adewumi *et al*., 2010:221; Bixio *et al*., 2006:89; Jhansi & Mishra, 2013:19; Ormerod & Scot, 2012:448) have shown that reclaimed water or wastewater that has been treated to levels suitable for reuse can provide a safe and reliable source for both non-potable and potable urban water supply. Despite these successes, negative public perceptions on wastewater reuse has been shown to be a major hindrance in the success of wastewater reuse initiatives (Marks, 2006:137; Nancarrow *et al*., 2008:485; Nancarrow *et al*., 2009:3199, Nancarrow *et al*., 2010:197, Wilson & Pafaff, 2008:1) and has led to failure in some instances (Hurlimann & Dolnicar, 2010:287). As a result, decision-making on wastewater reuse is often driven more by public perceptions of risks rather than a scientific risk assessment (Friedler *et al*., 2006:360; Okun, 2007:47; Po *et al*., 2005:20) This is an indication that public acceptance of wastewater reuse must be addressed comprehensively before implementation of the initiatives can be successful.

This study assesses the perceptions of consumers in the Vaal Triangle areas on wastewater reuse. Gauteng Province, where the Vaal Triangle area is situated, is one of the areas with high water demand compared to available water supply (Adewumi, 2011:14; DWA, 2012:9; Stoakley, 2013:1) as it is the economic hub of the country due

to population growth and economic activities in this Province. In addition, intensive industrial, mining and urban development in Gauteng Province aggravates the problem. Gauteng's Water Services Provider extracts water from the Vaal River System (VRS). At present, the demand is already exceeding the yield due to rapid urbanisation and vulnerability of the system to cope in times of drought (Rand Water Annual Report, 2012; DWA, 2006:7). It is estimated that the yield of the VRS system will remain nearly constant over the next ten years (DWA, 2006:10). The increasing demand and constant yield of the VRS will cause water supply shortages in the near future, necessitating a need for alternative water sources to be explored.

For wastewater reuse initiatives to be successful public acceptance is imperative. This is achieved by overcoming negative perceptions of the public on wastewater reuse. This study assesses perceptions of consumers in the Vaal Triangle on wastewater reuse. Information sources used to obtain environmental information will also be assessed. The outcomes of the research will be available to inform the future implementation of water reuse projects in the study areas with regards to important considerations and opportunities for planning and successful implementation of such projects.

This chapter provides the background and problem statement of this study. The primary and secondary objectives of the study are subsequently presented, together with the methodology used in order to achieve these objectives. It concludes with an overview of the structure of the study by briefly describing the content of each chapter.

1.2 PROBLEM STATEMENT

Wastewater has a potential to be used as additional source of potable water, however, studies (Hartley, 2006:116; Lazarova *et al*., 2003:69; Smith, 2011:20) in different countries have shown that in general, people reject potable water reuse, resulting in failures of water reuse projects (Dolnicar & Hurlimann, 2009:1433; Hartley, 2006:116; Hurlimann & Dolnicar, 2010:287; Lazarova *et al*., 2003:69; Smith, 2011:20). Generally people oppose wastewater reuse due to several reasons which include beliefs,

attitudes, fear, lack of knowledge and general distrust (Alhumoud, 2010:141; Dolnicar & Schafer, 2009:60; Hurlimann, 2009:265).

Public attitudes such as perceptions on wastewater reuse as well as social and cultural aspects play an important role in the success of reuse programmes (Alhumoud & Madzikanda 2010:150; Dishman *et al*., 2009:157; Duenas, 2009:5; Lazarova *et al*., 2003:69; Ross *et al*., 2014:61). According to Dishman *et al*. (2009:157), the problems associated with potable reuse may be resolved, but lack of public acceptance may kill the project. Findings have shown that opposition by members of the public has the ability to cause wastewater reuse projects to fail (Abu-Madi *et al*., 2008:20; Is'eed *et al*., 2008:14). Therefore, success of direct potable reuse of wastewater will likely depend on the consumer's willingness to accept wastewater as a source of drinking water (Dishman *et al.*, 2009:157; Husain & Ahmed, 1997:108). Additionally, water reuse practices have to be adapted to each local situation in order to be safe, amenable, beneficial and sustainable (NSWR1, 2011:1; NSWR2, 2013:29).

It is therefore important for water services institutions to determine the perceptions (attitudes) of their consumers on water reuse. This will help the organisations to develop strategies on combating any negative perceptions, educate the consumers (public involvement and participation) and gain their trust before implementation. This will improve confidence of consumers on the potable and other reuses of wastewater, hence the importance of this study.

1.3 OBJECTIVES OF THE STUDY

The research objectives of this study are divided into primary and secondary objectives.

1.3.1 Primary objectives

The primary objective of this research is to assess the perceptions of consumers within the Vaal Triangle area on wastewater reuse.

1.3.2 Secondary objectives

To achieve the primary objective of the study, the following secondary objectives were formulated:

- To conceptualise public perceptions on wastewater reuse by conducting a literature review of prior research into public perceptions.
- To empirically identify factors that affect consumer's perceptions on wastewater reuse.
- To assess the degree to which consumers are receptive to wastewater reuse.
- To determine the reasons why the consumers are/are not receptive to wastewater reuse.
- To assess the level of knowledge of consumers on wastewater reuse
- To establish the information sources used by consumers to gain information on wastewater use.
- To determine the relationships between the variables and constructs that measure perceptions.
- To draw conclusions from the empirical study and propose recommendations on how to develop strategies for gaining consumer acceptance on future wastewater reuse initiatives.

The scope of the study is outlined below.

1.4 SCOPE OF THE STUDY

The study involves principles of Organizational Behaviour specifically the Theory of Planned Behaviour which according to Ajzen (cited in Adewumi *et al*., 2014:12) states that "An individual's behaviour is determined by the person's intention to engage in the behaviour. Intentions are predicted on three factors: the attitudes, subjective norms and behavioral control". These are applicable in this study as they will result in persons having a positive or negative predisposition towards wastewater reuse.

The study focuses on perceptions or attitudes of consumers on wastewater reuse. The country is now faced with the challenge of water security and plans are in place nationally to reuse wastewater to augment freshwater resources. Water service institutions and authorities will have to address the perceptions of the customers in order to develop strategies to gain customer buy in.

The research method used for this study is discussed below.

1.5 RESEARCH METHODOLOGY

The research will be conducted in two phases: a literature survey on perceptions of the public on wastewater reuse followed by an empirical study. Additionally, the research design, research instrument, data collection and data analysis methods to be used in this study will be outlined.

1.5.1 Phase 1: Literature review

An analysis of various relevant publications will be done to conduct literature survey of this study. Relevant scientific journals, articles, books, legislation and research documents will be assessed and applied in this study. The following databases have been consulted, amongst others:

- Internet
- Google Scholar
- EbscoHost
- Science Direct
- Dissertations
- Experts and other people
- Department of Water Affairs publications: relevant legislations and documents
- Published books
- Scientific journals

An empirical study is conducted after the literature on public perceptions has been assessed.

1.5.2 Phase 2: Empirical study

An empirical research investigation based on descriptive research approach will be used to achieve the objectives of this study. This type of research is used to understand the status quo by explaining the phenomena by showing the relationships between variables and also predicting behaviour which may enable changing or control of such behaviour (Welman *et al*., 2005:23). Descriptive research studies are used to achieve research objectives that involve characteristics associated with a subject population, estimates of the proportions of a population that have these characteristics, and the discovery of associations amongst different variables (Cooper & Schindler, 2008:151). As a result this type of research design was chosen as relevant to assess the perceptions of consumers on wastewater reuse.

Furthermore, research methods used in descriptive research design are structured and quantitative in nature (Tustin *et al*., 2005:86). Quantitative research aims to quantify data and is used for larger numbers of samples and results are analysed based on statistical significances. Qualitative research on the other hand is unstructured, exploratory in nature and based on small numbers of samples studied in-depth (Malhotra, 2007:143; Welman *et al*., 2005:9). Quantitative data allows one to draw conclusions related to a wider group and data; hence this approach was selected as it is more suitable for this study.

In addition to the quantitative approach, qualitative research is also undertaken in this study by including questions where participants can state their views. The combination of the two methods will assist in uncovering more information as it will have more advantages than using either of the two approaches alone.

1.5.2.1 Population, sample and sampling technique

The target population is adults of 18 years of age and above residing in the Vaal Triangle area. The Vaal Triangle is a triangular area of land formed by Vereeniging, Vanderbijlpark and Sasolburg. Sebokeng, Sharpeville, Zamdela, Heidelberg and Meyerton also form part of the Vaal Triangle (Figure 1). The Vaal Triangle area is an area where wastewater reuse (direct or indirect potable reuse) has not yet been implemented for public use.

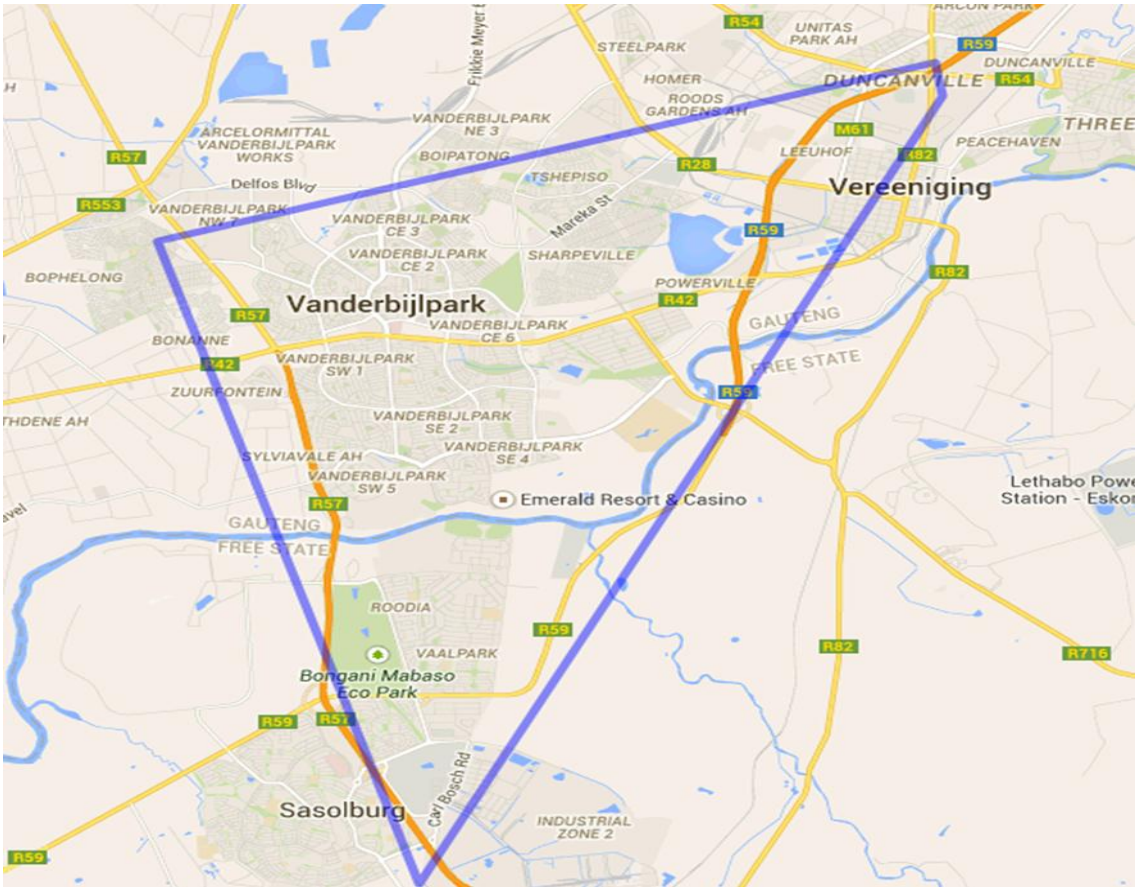

Figure 1.1: Map of the Vaal Triangle region showing geographical demarcation (source: https://maps.google.co.za/maps).

A convenient sample of adults of different cultures and different professional skills is targeted in the study. A random sampling approach is the most preferred sampling

approach as it is more accurate than other sampling methods; however, it is more time-consuming and costly. Hence a convenience sampling was followed in this study as it is quicker, less costly and allows for a quick understanding of certain trends (Welman *et al*., 2005:70).

The present study assesses factors affecting public acceptance of wastewater reuse and as a result does not require the sample to be representative. However, ensuring variety in variables which play a role is more important (Dolnicar *et al*., 2011:935). Hence a sample was drawn in a way that ensures this variety. The sample was selected to give a more diverse group of participants in terms of gender, race, socio-economic status, and educational experience i.e. highly skilled to non-skilled residents. The questionnaires were distributed in all areas with more questionnaires being distributed in the townships as these have more residents (as outlined in Table 1.1) Stats SA 2011 data was used to compile Table 1.1.

Table 1.1: Statistics of the population in the Vaal Triangle area as per StatsSA 2011 data

Municipality	Vaal Triangle Area	Township/ Town	Estimated Population based on literature	Estimated Population based on Stats SA 2011
Midvaal	Heidelberg	Township/ Town	12000	95301
	Meyerton	Township/ Town	12000	
Metsimaholo	Sasolburg	Town	34000	149103
	Zamdela	Township	90000	
Emfuleni	Vereeniging	Town	90000	721663
	Sharpeville	Township	250000	
	Vanderbijlpark	Town	80000	
	Sebokeng	Township	250000	

A sample of **300** completed questionnaires and above was targeted in this study with a response rate of 50% and above. Seven hundred questionnaires were distributed via email and personal delivery. Two field-workers were hired and trained on how to help

the respondents complete the questionnaires. The field-workers targeted locations with waiting people and also went to the houses in Vereeniging, Vanderbijlpark and Sasolburg town and associated townships. A total of **515 completed questionnaires** were received, yielding a response rate of 74%.

1.5.2.2 Measuring instrument

A quantitative research approach was followed. The research is based on predictive correlational study of the public knowledge, attitudes and information sources concerning wastewater reuse. For the quantitative aspect, a questionnaire instrument was developed based on literature findings to assess these parameters along with selected demographic characteristics. On the basis of the results of the investigation, the researcher hoped to predict that better knowledge and information on wastewater reuse will result in positive attitudes and perceptions on wastewater reuse, hence a correlational analysis measuring the relationship between the variables will be performed on the data.

Additionally, the questionnaire includes qualitative aspects to allow the participants to express their views or make suggestions to enable a better understanding of consumers' perceptions and hence development and implementation of strategies that are effective.

The participants were given questionnaires to complete. These were then analysed to ascertain the perceptions of the respondents on wastewater reuse. This instrument is more applicable to the study as many respondents can be reached in a short period of time, it is less costly and easy to apply and the respondents can remain anonymous. The measuring instrument was adapted from published literature which measures perceptions and attitudes on wastewater reuse (Alhumoud, 2010:141; Dolnicar & Schafer, 2009:60; Hurlimann, 2009:262). Perceptions are assessed using several questions on acceptance of wastewater reuse.

1.5.2.3 Validity and reliability of the measuring instrument

Reliability and validity were considered when evaluating the selected instrument. Bless and Higson-Smith (2000:29), define reliability as the consistency of the instrument, and that an instrument is reliable if it gives an accurate and consistent measurement of an unchanging value, whereas validity of an instrument refers to how well an instrument measures the particular concept it is supposed to measure (Whitelaw, 2001:108).

According to Schmitt (1996:350) the Cronbach's Alpha co-efficient based on the average correlation of variables within a test is used to measure the reliability of the instrument. The Cronbach's Alpha coefficient should be greater than 0.70 for the data to be regarded as reliable and internally consistent (Schmitt, 1996:351). Generally, alpha values above 0.70 are acceptable; however, Field (2005:668) reported that when attitudes and not abilities are tested, a score of up to 0.6 could still be acceptable.

Cronbach's alpha co-efficients are not necessary to assess the reliability of the constructs that are measured as the statements are not grouped together to measure a particular construct (Adewumi *et al*., 2014:16); each statement is intended to measure the intention to accept/reject wastewater reuse. Despite this, the measurements were done to test the reliability of the measuring instrument as it was important to assess whether the instrument was measuring what it is intended to measure.

1.5.3 Data analysis

After the collection of questionnaires from respondents, the qualitative data were captured by the researcher, the quantitative data were captured and analysed at Statistics Department at the North-West University using the following methods:

- Descriptive statistics: These include total numbers, frequencies, percentages of responses, measures of central tendency (mean), standard deviation (measure of variation).
- Correlations: to investigate inter-relationships

- Comparisons: to compare groups
- Trends

The captured data were analysed using the SPSS and STATISTICA statistical programmes (SPSS Inc., 2007; StatSoft, Inc., 2006), with the assistance of the Statistical Consulting Services of the North-West University.

1.5.4 Research hypothesis

In this study, the following hypotheses were stated in predicting whether the respondents would accept or reject wastewater reuse:

H1: Respondents' knowledge of wastewater reuse will have a positive effect (acceptance) of wastewater reuse.

H2: Respondents will be more accepting of wastewater reuse for uses with less physical contact

1.5.5 Ethical considerations

The following ethical aspects were considered and applied:

- Full information disclosure was undertaken: participants were informed on why the information was needed, what would be done with it, and the results would be made available to participants who wanted it.
- Anonymity of participants was ensured.

1.6 VALUE ADD OF THE STUDY

The contribution of this study has been to illustrate to what degree (extent) the Vaal Triangle consumers are receptive to wastewater reuse, and the possible link between perceptions and the acceptance of wastewater reuse. This kind of study had not been conducted in this particular environment before, and as such a valuable contribution

could be made that in turn could help Water Services Authorities and providers to develop strategies for successful wastewater implementation in this area.

The layout of the study is summarized below.

1.7 LAYOUT OF THE STUDY

This study is divided into four chapters:

- **Chapter one** introduces the content of the study and explains why the topic was chosen for the research. The chapter presents the problem statement, the research goals and research methods employed to achieve the goals of the research project. Aspects covered on research method include research design, measuring instruments used to gather data and data analyses techniques are discussed.
- **Chapter two** covers the literature study on public perceptions of wastewater reuse. This chapter outlines the water security challenges worldwide and in South Africa, leading to wastewater reuse as a means of augmenting water supplies. The challenges faced when implementing wastewater reuse and success factors leading to wastewater reuse are discussed and applied within the South African context.
- **Chapter three** focuses on the results of the study. The research findings are discussed, focusing on their implications for Water Services Institutions and South African Regulation.
- **Chapter four** discusses the conclusion reached resulting from the study, recommendations to Water Services Providers as well as recommendations for future studies.

1.8 CHAPTER SUMMARY

This chapter provided an introduction to the study as well as motivation for this study. The problem statement, primary and secondary objectives, scope, research methodology, limitations and layout of the study were provided. Chapter two will deal with the literature survey relevant to the current study.

CHAPTER 2: THEORETICAL OVERVIEW

2.1 INTRODUCTION

Water is essential for socio-economic development and for maintaining healthy ecosystems. Properly managed water resources are a critical component of growth, poverty reduction and equity. The livelihoods of the poorest are critically associated with access to water services (World Bank, 2010:10). Water is, however, a limited resource. Hence, population growth, access to water and climatic conditions impact negatively on water availability necessitating that other water sources be used to augment the available surface water resources (Alhumoud & Madzikanda, 2010:141; Dolnicar & Schafer, 2006:168; Dolnicar *et al*., 2011:791; Tindall, 2008:21; Tindall & Campbell 2009:16; Higgins *et al*., 2002; Stenekes *et al*., 2001; NWRS1, 2011:10). In South Africa, the Department of Water Affairs released a National Water Resource Strategy (NWRS2, 2013) which highlighted the need for implementing other water supplies and presented reconciliation options such as water conservation and demand management, groundwater, desalination, rainwater harvesting and water reuse as the potential for the development of conventional surface water resources such as large storage dams is limited (NWRS2, 2013:10).

2.2 BACKGROUND TO THE STUDY: URBAN WATER SCARCITY

Among the most immediate environmental issues facing the world today is the lack of sufficient freshwater resources (NWRS2, 2013:1). Urban water scarcity is a growing concern in many areas of the world due to climate change, population growth, demographic changes and rapid urbanization (Alhumoud & Madzikanda, 2010:141; Dolnicar & Schafer, 2006:168; Dolnicar *et al*., 2011:791; Tindall, 2008:21; Tindall & Campbell, 2009:16). These changes pose serious challenges to secure water supplies for future generations, as humans use more and more water each year. The United Nations estimates that more than three billion people may suffer from water shortages by the year 2025 (United Nations, 2010).

In the past two decades it has become increasingly evident that there will not be enough fresh water on Earth to meet all human needs in the near future without people changing the way they view, value, allocate and manage water (DWA, 2004:20; DWA, 2006:8; DWA, 2012:8; DWA, 2013; van Koppen *et al*., 2011:8). Countries around the world - even those with relatively abundant water resources – are facing problems of supply and quality in the face of growing populations and increased competition for use (Tindall, 2008:21). Furthermore, water pollution is rendering some global fresh water unsuitable for use and thus further exacerbates the situation (Adewumi *et al*., 2010:221). According to Bigas (2012:22), the levels of the global freshwater crisis and the risks associated with it have been greatly underestimated. One billion people on earth are without reliable supplies of water, and more than two billion people lack basic sanitation. Water is critical to the attainment of the United Nations Millennium Development Goals whose targets are set to expire in 2015; it is already known that the world lags far behind on the sanitation target, which is predicted to be missed by over one billion people

Water security is also the foundation for food and energy security, and for overall long-term social and economic development (United Nations, 2010). Water underpins health, nutrition, equity, gender equality, well-being and economic progress, especially in developing countries. But equitable water supplies and quality problems are also threatening the security of some of the most developed countries in the world. In the USA, for example, water availability has already been identified as a national security concern, threatening its ability to meet the country's water, food and energy needs (Dallapenna, 2005:830). Therefore, by addressing critical water issues, governments will simultaneously address economic and public health challenges while advancing the capacity to adapt to climate change and create a foundation for peace and well-being (Dallapenna, 2005:828).

2.3 URBAN WATER SCARCITY IN SOUTH AFRICA

In South Africa, the Department of Water and Sanitation (DWS), the custodian of water resources, has identified water scarcity in the country's major urban centres (DWA, 2006:7; DWA, 2007:8; DWA, 2008:13; DWA, 2011:2; NWRS1, 2011:2; NWRS2, 2013:10). These major urban areas anchor the country's economy, and the Department has reached a point where it knows that it must invest heavily in the diversification of its water mix to avert serious water shortages that could impact adversely on the economy by exploring the future of water augmentation options to narrow the gap between water supply and demand (DWA, 2010). DWA is looking water reuse (wastewater) and reduction of unaccounted for water from 30% to 15% as options in addition to water demand and conservation (NWRS1; 2011:5; NWRS2, 2013:2).

The purpose of the literature review is to examine key concepts and related research relevant to wastewater reuse and perceptions of consumers on wastewater reuse. The following topics are identified as important: defining wastewater, wastewater reuse and its importance, successes and failures of wastewater reuse, perceptions on wastewater reuse as well as instruments used for measuring perceptions on wastewater reuse. Each of these topics is reviewed and critiqued relevant to the study.

2.4 THE NEED FOR WASTEWATER REUSE

In light of potential water shortages, cities have increasingly recognized the importance of water conservation and water demand management as a long-term water supply option. However, in some cases, water conservation is not enough to close the water supply-demand gap and alternatives for augmenting water supply must be considered (Po *et al*., 2005:1). Wastewater reuse is a viable option that has been considered and implemented in some countries.

In South Africa, the main driver for wastewater reuse is water security (NWRS1, 2011; NWRS2, 2013). South Africa has a limited supply of water with an uneven geographic distribution thereof, highly variable rainfall, intensive industrial, mining and urban

development creating a vital need for water reuse in the country (Adewumi *et al*., 2014:11; Adewumi *et al*., 2010:221; Stoakley, 2013:1; van Niekerk & Schneider, 2013:2; Wilson & Pfaff, 2008:3). Water reuse and recycling are thus undeniably necessary supplements to fresh water use (NWRS2, 2013:10; van Niekerk & Schneider, 2013:2).

Studies have shown that wastewater that has been treated to levels suitable for reuse can provide a safe and reliable source for both non-potable and potable urban water supplies (Bixio *et al*., 2005:77; Wintgens *et al*., 2005:2). In South Africa, the Reconciliation Strategy Studies for the metropolitan areas have identified the use of treated effluent as a major potential source of water, especially in coastal cities where the bulk of the effluent is currently discharged into the sea (DWA, 2006:7; DWA, 2007:8; DWA, 2008:13; DWA, 2011:2).

2.5 BENEFITS OF WASTEWATER REUSE

The benefit of treated effluent includes the immediate availability of the water source with high assurance of supply and water is already being treated through invested costs of infrastructure and human resources (Adewumi *et al*., 2014:11). Where current treatment does not adhere to standards for discharge into rivers, the treated effluent can be used for economic activities (Adewumi *et al*., 2010:6).

Other benefits of wastewater reuse include pollution reduction to reduced effluent discharged into the rivers, decrease in the use of freshwaters, renewal of soil nutrients, improvement of ground water recharge and delay in infrastructure expansions for water supplies (Adewumi *et al*., 2010:251)

Preliminary comparisons have indicated that the use of treated effluent is becoming cost-effective, and this may well be cheaper than the desalination of seawater. As reuse would happen more than once, the effective increase of the available resource will be considerably more than the portion recycled and the primary resource need only be used to top up the water that is being recycled (Adewumi *et al*., 2010:222; Dolnicar & Schafer, 2006:6). Friedler *et al*. (2006:361) assert that three most common advantages

of reusing wastewater at the household scale were cost-saving (71%), positive outcomes on the environment (36%) and saving potable water (34%). The treatment of water also reduces the environmental difficulties of disposal (Adewumi *et al*., 2010:222; Dolnicar & Schafer, 2006:6). These studies indicate that there are merits in reusing wastewater.

2.6 WASTEWATER AND WASTEWATER REUSE

2.6.1 Wastewater reuse

The NWRS2 (2013) defines water reuse as:

> *Utilisation of treated or untreated wastewater for a process other than the one that generated it, i.e. it involves a change of user. For instance, reuse of municipal wastewater for agricultural irrigation. Water reuse can be direct or indirect, intentional or unintentional, planned or unplanned, local, regional or national in terms of location, scale and significance. Water reuse may involve various kinds of treatment (or not) and the reclaimed water may be used for a variety of purposes.*

Effluent can be treated to different levels for different uses subject to available water and the quality of treated wastewater. Different users include public and private irrigation (e.g. golf courses, playground and sport fields), agricultural irrigation, air-conditioning, toilet flushing, car washing, building and street washing, fire protection, construction concreting and dust control and industrial processes as summarized in Table 2.1 (Adewumi *et al*., 2010:253; Okun 2002:275; Yang & Abbaspour 2007:240).

Table 2.1: Classification of treated wastewater end users (Adopted from Adewumi *et al*., 2010)

Category	Examples of reuse
Domestic	Toilet flushing, garden/lawn irrigation and car washing
Landscape and recreational irrigation (Urban)	School fields, parks, golf courses and sport fields
Industry	Cooling, boiler feed and process water (except in food industries)
Others	Construction, street flushing, fire protection and groundwater recharge
Agricultural irrigation (restricted/unrestricted)	Irrigation of food crops consumed raw, fruit trees using sprinkler irrigation and irrigation of greenhouse crops

According to Lazarova *et al*. (2002:69), toilet flushing accounts for approximately 30% of in-door domestic water usage. This indicates that a large volume of potable water can be saved with the reuse of non-potable water for items such as toilet flushing, garden irrigation and car washing.

Application of wastewater reuse for industrial purposes is a first option as they require a large volume of water (2030 WRG, 2013:106). Additionally, the exchange of treated effluent with fresh water used for irrigation is another possibility. However, to make full use of the opportunity, the bulk of the effluent should be treated to potable standards (2030 WRC, 2013:112). While the technology is available to do so (having first been developed in South Africa and implemented in Windhoek in Namibia), it has not been used on a large scale elsewhere in the world (2030 WRC, 2013:112). The treating of effluent to potable standards should not at this stage been seen a solution to water scarcity in small towns due to the sophisticated treatment that is required, demanding both technical skill and equipment. Lower standards could be applied to provide water for food gardens and crops.

2.6.2 Wastewater reuse options / choices

The water recycling may take a number of forms, each with substantially different costs, quantities and value to the end user. There are five key drivers that affect the choices of water reuse options to be used. These are: water quality and security of supply; water treatment technology, cost relative to other water supply options, social and cultural perceptions and environmental considerations (NWRS2, 2013:3). The various forms of wastewater reuse options include:

- *Industrial reuse*

Commercial users may apply water in cooling, wash-down or other industrial processes. In some cases, recycled water can be treated through reverse osmosis or similar processes to obtain a high quality water product. This will have some cost implications. The quantity that can be recycled is constrained by the number of industries within close proximity of a wastewater treatment plant that can make use of recycled water in their processes (NWRS2, 2013:6).

- *Agricultural reuse*

Substantial volumes of recycled water could be made available for agricultural use. Agriculture accounts for about 60% of total use in South Africa and only a small amount of that water is from treated wastewater (NWRS2, 2013:6). Hence there is a great potential for agricultural use of wastewater in South Africa.

- *Third-pipe residential*

Treated wastewater can potentially be used for non-drinking purposes such as garden watering and toilet flushing. Although there are no third-pipe schemes in South Africa, there may be benefits in implementing these schemes. The benefit of third-pipe schemes often hinges on the ability to reduce costs in other parts of the water supply or wastewater system (NWRS2, 2013:6).

- *Indirect potable reuse*

Potable water reuse has two forms; indirect potable reuse (IPR) and direct potable reuse (DPR). This is water that is treated to an extremely high quality and then returned into a river, surface- or ground-water supply for eventual re-extraction and use in the potable water supply system. Although this is being done in some areas, which are highly water-stressed such as the Crocodile (West) River system, and other areas, there is scope for increasing indirect potable reuse. Indirect potable water reuse (IPR), a more supportable choice, has worked well for in different parts of the world. However, according to Chain (2011:1) the most sustainable option is direct potable reuse (DPR).

- *Direct potable reuse (DPR)*

This solution entails the introduction of highly-treated wastewater into the drinking water treatment process to produce drinking water (Cain, 2011:10). DPR solves the problem of unreliable raw water resource availability due to water scarcity/water stress, population and demographic pressures, polluted freshwater sources, and costly deliverance of water from distant locations (Cain, 2011:2). Until recently, DPR was not even considered as an option for augmenting drinking water. However, remarkable developments in water treatment technology, water quality monitoring, constituent detection and health risk analysis systems have occurred since then. As a result, scientific/public health researchers, water-industry specialists, policy-makers and community stakeholders have been taking a different view of DPR's possibility. DPR acceptance is determined by identifying and solving fears concerning treatment train technology, health risks, regulatory issues, management and operational controls, public perception issues and costs associated with DPR (NWRS2, 2013:6).

2.6.3 Wastewater reuse successes

Countries like Namibia (Goreangab Water Reclamation Plants) and Singapore (New Water) make use of reclaimed water (wastewater that has been treated to levels suitable for reuse) and can provide a safe and reliable source for both non-potable and

potable urban water supply (MAWF, 2008:13). Recent technological advances have reduced the technical and economic barriers to reusing wastewater; however, political, cultural, and regulatory challenges remain in other countries (2030 WRG, 2013:112).

The only location in the world utilizing direct potable reuse is Windhoek, Namibia. Located in Africa's southwest region, Namibia experiences relentless droughts, is ranked as sub-Saharan Africa's most arid country and is fed by two distant perennial rivers, both over 700 kilometres from Windhoek. Ephemeral river-based surface water is a highly unreliable water source and groundwater is sparse. The Goreangab Water Reclamation Plant (OGWRP) was constructed and opened in 1969 to utilize final effluent from the city's wastewater treatment plant (GWCW) which processed domestic (not industrial) wastewater. The final effluent from the OGWRP was mixed with other potable water and sent directly into the distribution line, and this is how DPR was born. The OGWRP underwent numerous upgrades but in 2002, the New Goreangab Water Reclamation Plant (NGWRP) was built and commissioned with cutting-edge technology, a "multiple barrier" approach, the water reclamation process. The NGWRP now utilizes 90% reclaimed water as its raw water source and consistently produces 21,000 m3/d of high-quality drinking water, providing up to 25% of the city's daily potable water needs (Lahnsteiner & Lempert, 2007; Neumann, 2013; UNEP, 2006; 2030 WRG, 2013:112).

Another case is that of NEWater in Singapore, the geographically water-challenged Singapore has emerged as a current leader in the water recycling world. Decreasing freshwater sources, escalating trans-country water importation costs, the 2011 expiration of Malaysia's water supply agreement, and population pressures pushed the Public Utilities Board (PUB) to predict this crisis and to begin plans in the 1970s for utilizing the city's sewage for drinking water purposes. This reclaimed, highly treated water, called NEWater, is produced by DPR treatment trains, bottled as drinking water, but is currently used via IPR for Singapore's tap drinking water. The 1998 Singapore Water Reclamation Study proved that NEWater could supplement the country's water supply safely as an additional raw water source. As of 2010, five NEWater plants meet 30% of Singapore's water demand and by 2011 2.5% of drinking water demand will be

furnished through IPR NEWater. Through the Water Reclamation Study and an international panel of experts, more than 65,000 analyses investigating over 290 parameters demonstrated that NEWater is cleaner than local drinking water (2030 WRG, 2013:106).

In South Africa indirect potable reuse of wastewater is done at Mossel Bay Wastewater Treatment Works and direct potable reuse of industrial (mine) water is done at eMalahleni Water Reclamation Plant in Witbank (NWRS2: 2013:11).

2.6.4 Challenges with wastewater reuse

Despite the potential of wastewater reuse as an additional source of water, studies in different countries have shown that, in general, people are not comfortable with the idea of wastewater reuse especially potable reuse. These studies have indicated that people reject potable water reuse, resulting in failures of water reuse projects (Alhumoud & Madzikanda, 2010:141; Cain, 2011:1; Dolnicar & Schafer, 2006:168; Dolnicar *et al*., 2011:791; Smith, 2011:2). The sound rejection of these initiatives showed the importance of addressing public concerns about health, fairness, scientific merit of a project, and above all, cost-effectiveness of a project, especially in comparison to other alternatives.

Hence it is important for Water Services Institutions to determine the perceptions (attitudes) of their consumers on wastewater reuse. This will help the institutions to develop strategies on educating the consumers (public involvement and participation) and gaining their trust before implementation. This will improve confidence of consumers on the potable reuse of wastewater.

2.7 LITERATURE ON PUBLIC PERCEPTIONS OF WASTEWATER REUSE

2.7.1 International perspective

A substantial number of studies have been performed worldwide to investigate the levels of public acceptance for recycled water (Alhumoud & Madzikanda, 2010:141;

Cain, 2011:1; Dolnicar & Schafer, 2006:168; Dolnicar *et al*., 2011:791). These studies have provided a picture of the public's opinions toward alternative water sources at the time of survey, which indicate that people can see the logic in using recycled water but remain reluctant to use it. Other studies have identified relations of high acceptance levels (Alhumoud *et al*., 2003; Hurlimann & McKay, 2004).

The following are the factors influence the public's acceptability of water reuse:

- **Disgust or "Yuck" factor (psychological reasons):** a disgust emotion resulting from the thought of using recycled water (Alhumoud & Madzikanda, 2010:141; Dolnicar *et al*., 2011:933; Marks, 2006:139; Schmidt, 2008:A524).
- **Perceptions of risk associated with using recycled water:** These are related to public health issues from using the water due to potential lethality of pathogens in the water and the unknown impact of chemicals used to treat the water (Dolnicar *et al*., 2011:934, Kaercher *et al*., 2003).
- **The specific uses of recycled water:** Studies have consistently shown that the specific use of recycled water affects the people's perceptions and acceptance of the water. The closer the recycled water is to human contact or ingestion, the more people are opposed to using the water (Dolnicar & Hurlimann, 2010; Dolnicar & Schäfer, 2006; Hurlimann, 2006; Hurlimann, 2007; Marks *et al*., 2006:140). In a study done by Dolnicar and Hurlimann (2010:375) 92% of Australian respondents stated that they would use recycled water for watering their gardens and only 36% would use recycled water for drinking.
- **The sources of water to be recycled** – studies showed that people perceive their own waste as being less offensive than other people's. Hence the source of water to be recycled, or use history of the water, was also found to affect the acceptability of recycled water (Jeffrey, 2002:214; Nancarrow *et al*., 2009:3199).
- **The issue of choice** – in areas where there are water shortages it may not be necessary to convince the consumers about use of alternative sources of water. In places where there were water shortage issues, people were reported to

readily accept water reuse because of the heightened awareness of the need to conserve water (Dishman *et al*., 2009:154).

- **Trust in the authorities and workmanship at the plant** including fear of mechanical breakdown at the plant (Alhumoud & Madzikanda 2010:150; Porter *et al*., 2000:10; Porter *et al*., 2002:2; Po *et al*., 2004:20).
- **Attitudes toward the environment** have also been found to influence people's perceptions of wastewater reuse (Po *et al*., 2005:10). For example, Jeffrey (2002:214) reported that people who had undertaken water conservation measures in their homes were more prepared to reuse grey water for toilet flushing from different sources.
- **The cost of recycled water:** implementing recycled water projects may not be feasible in some areas due to economic constraints. Consumers are not willing to pay more for recycled water as has been seen in a study by Hurlimann (2009:262) where the cost of delivering recycled water was 34 times more than the cost of delivering main water. In areas experiencing prolonged water scarcity and restrictions to water use recycling may be economically possible Hurlimann (2009:262).
- **Socio-demographic factors**: education of people expressing their opinions, age, knowledge about wastewater reuse, income and gender have been found to affect the perceptions of consumers on wastewater reuse (Alhumoud & Madzikanda 2010:150; Duenas, 2009; Ross *et al*., 2014).
- Another reason reported for by Alhumoud and Madzikanda (2010:150) for rejecting wastewater is the matter of **religious beliefs**

Most studies investigating public acceptance of wastewater reuse come to the same conclusion that people are very open to using recycled water for uses with low personal contact, such as watering the garden, but are unwilling to accept recycled water for uses with high personal contact, such as drinking, bathing or cooking (Marks *et al*., 2006:4; Hurlimann & Dolnicar, 2010:288; Dolnicar & Schäfer, 2006:138; Friedler *et al*., 2006:360; Hurlimann, 2006:59; Hurlimann, 2007:58). For example:

- Dolnicar and Hurlimann (2010:6) found that 92% of Australian respondents would use recycled water for garden watering, but only 36% for drinking.
- A significant concern related with the reuse of wastewater is the contamination of crops (Adewumi *et al*., 2014:12)
- Contamination of potable water supplies by bacteria, viruses and other pathogens (Adewumi *et al*., 2010:229).
- Any effluent used as a source of water should be treated to the appropriate water quality standards for that use before use (Adewumi *et al*., 2014:12).

2.7.2 South African perspective

At present, in South Africa it is estimated that up to 14% of water use in South Africa is reused, mostly through wastewater return flows to rivers from which it is abstracted further downstream for indirect reuse (NWRS2, 2013:12). Additionally, reuse of return flows could be significantly increased, especially in coastal cities where treated wastewater normally drains into the oceans (van Niekerk & Schneider, 2013:2). Water reuse has been identified as one of the important strategies to augment water availability in South Africa (Adewumi *et al*., 2010:251; NWRS2, 2013:2). The National Water Resource Strategy stresses that the implementation of water reuse have to overcome the negative perceptions and risks related to public acceptance for these projects to be successful (NWRS2, 2013:10). An understanding of public perceptions will enable proper strategies to be developed and implemented to enhance understanding and promote informed decision-making related to wastewater reuse.

2.7.2.1 Studies on perceptions of South Africans on wastewater reuse

It is important to note that despite the fact that there have been numerous studies done worldwide on public perceptions on wastewater reuse, there are relatively few studies that have been documented on the perceptions of South Africans on wastewater reuse. According to van Niekerk and Schneider (2013:13), the perceptions of South Africans differ on wastewater reuse especially when it relates to direct or indirect water reuse for domestic and potable applications. One of the studies was conducted by Wilson and

Pfaff (2008:1-9) to ascertain perceptions of Durban's communities on wastewater reuse. This study revealed that people's concerns regarding wastewater reuse are emotional (yuck factor) and technical competency in operating the plants. Furthermore, this study revealed that people are not comfortable with potable water use and feel that water reuse should start with big industries before households. The study concluded that the public would accept wastewater reuse as a last resort and would need more information, understanding and satisfactory quality assurance for them to accept potable reuse (Wilson & Pfaff, 2008:1-9).

Stoakley (2013:1) assessed perceptions of South African University (University of Pretoria and University of Cape Town) students on water recycling utilizing an online survey to collect responses. The study findings were that there is a high degree of acceptability when the water was used watering gardens and toilet flushing. This is agreement with the studies done worldwide which revealed more acceptability when physical contact with the water is low. In addition, Stoakley found that acceptance increased when there was assurance that the water reuse system would benefit the environment. The perceptions were also positive when the consumers were told they would experience water shortages without water reuse (Stoakley, 2013:1-20).

A recent study was conducted by Adewumi and his colleagues (2014:11-19) on factors predicting the intention to accept treated wastewater reuse by domestic and non-domestic users in the Capricorn and Vhembe areas (Limpopo Province). The study concluded that knowledge of the advantages of wastewater reuse, the degree of control over the source water and its application, attitudes towards wastewater reuse, trust in the service providers and subjective norms of the respondents influences the intention of the consumers to accept wastewater reuse.

2.8 CONCLUSIONS

There is clearly a need for wastewater reuse, both worldwide and in South Africa. For wastewater reuse projects to be successful any negative perceptions by consumers need to be addressed. The survey conducted on available literature on public

perceptions on wastewater reuse indicates that very few studies have been conducted in South Africa despite a clear need that has been pointed out by the National Resource Strategy in 2011 and 2013 (NWRS1, 2011; NWRS2, 2013). Furthermore, a study of consumers' attitudes towards wastewater reuse has never been conducted in the Vaal Triangle region; this is the first study which will assist in developing strategies for addressing consumer's perceptions towards wastewater reuse.

2.9 CHAPTER SUMMARY

This chapter provided a motivation or need for wastewater reuse by looking at the drivers of wastewater reuse worldwide and in South Africa. A background to wastewater was outlined. Projects were wastewater reuse has been successfully implemented were given. Additionally factors that affect successful implementation of wastewater reuse were outlined of which overcoming the negative perceptions of consumers have been identified as the greatest obstacle. Hence perceptions of consumers on wastewater reuse are the topic of this study. Factors that affect the perceptions of consumers on wastewater reuse as well as most / least acceptable wastewater reuse options were discussed.

Chapter 3 presents the results from the empirical study.

CHAPTER 3: RESULTS AND DISCUSSIONS

3.1 INTRODUCTION

This chapter reports the results of the empirical study and discusses the findings. The questionnaire was designed by including factors identified to affect perception of wastewater reuse in literature.

The biographical information will be discussed followed by an interpretation of the data from the instrument used and finally, the hypotheses will be tested and reported on.

3.2 BIOGRAPHICAL INFORMATION

The biographical information: gender, age group, race, level of employment, and qualification will be reported. Additionally, knowledge of wastewater reuse and knowledge of water scarcity will be reported under this section. The numeric dispersion of the sample is indicated in Appendix Table 1.

A total of 515 questionnaires were received from the 700 questionnaires that were distributed, representing a response rate of 74%. The sample consists of 515 respondents with 214 males (49.1%) 257 females (50.9%). These results indicate an almost equal split between the male and female respondents (Figure 3.1).

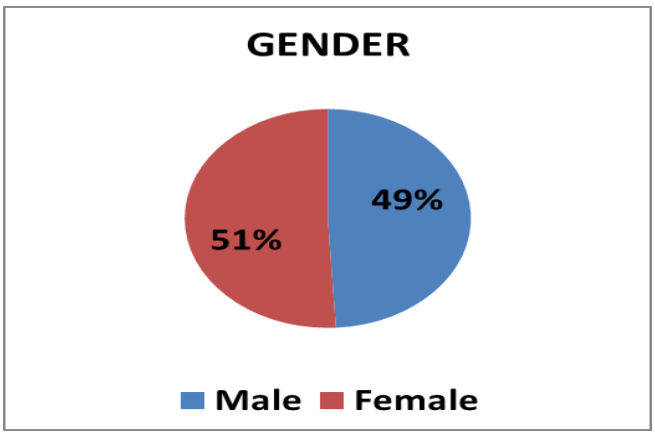

Figure 3.1: Split between male and female respondents

The numeric split between the age groups of the respondents is indicated in Figure 3.2. The largest age group is between 31 and 40 years old with 164 respondents (32.7%) following those who indicated that they were between 21 and 30 years old with 134 respondents (26.7%). The third largest group is between 41 to 50 years old with 89 (17.7%) followed by those less than 21 years old with 64 respondents (but older than 18 years) (12.7%). The 38 (7.6%) respondents are the second smallest group with ages between 51 and 60 years. Finally, the smallest group was that of persons greater than 60 years old with 13 respondents (2.6%).

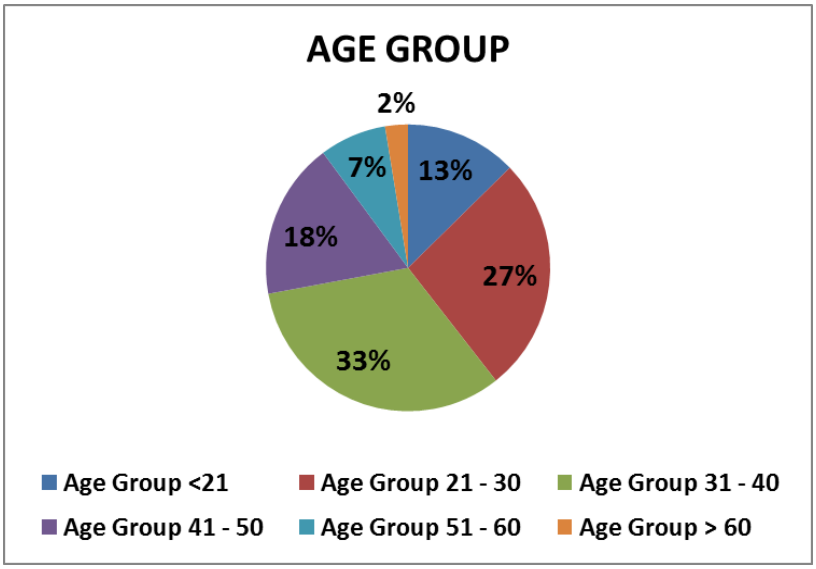

Figure 3.2: Split between respondents per age groups

Regarding the race (Figure 3.3), the largest group is those 388 (77%) who indicated that they were Blacks. The second largest group was Whites with 70 respondents (13.9%) whilst the Coloured and Indians Coloureds were 4.6% (23 respondents) and 4.2% (21 respondents) respectively.

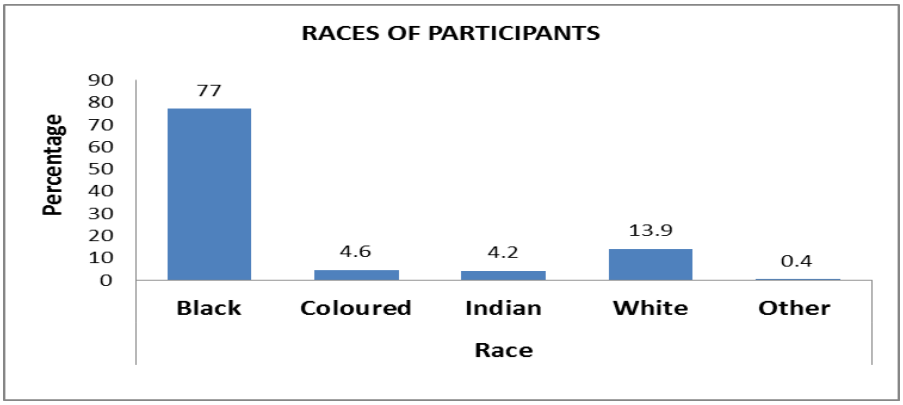

Figure 3.3: Comparison of percentages of participants' races

In terms of qualification (Figure 3.4), majority (27.2%) of the respondents have a degree followed by those who have a certificate or a diploma (22.0%) and matric (21.5%), then the respondents who have a post-graduate qualification (17.7%) and lastly those who have no qualification (no matric) are in the minority (11.6%).

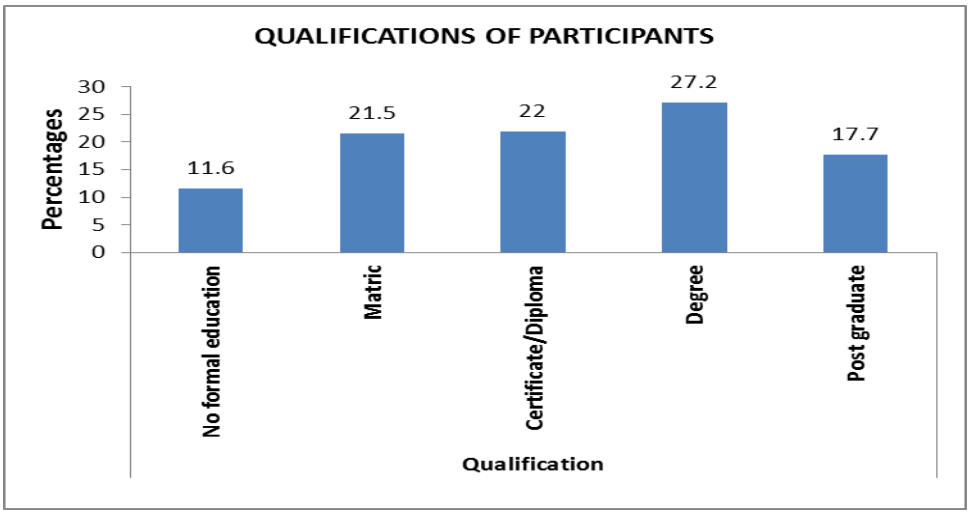

Figure 3.4: Qualifications of participants

The majority of respondents are in middle level positions (29%) followed those who are unemployed (23.3%), then junior level employees (22.3%) and senior level positions (13.6%). The 5.9% of the respondents indicated that they are in non-management

positions whereas 5.9% indicated that their job positions fall in other categories which were not indicated in the study (Figure 3.5).

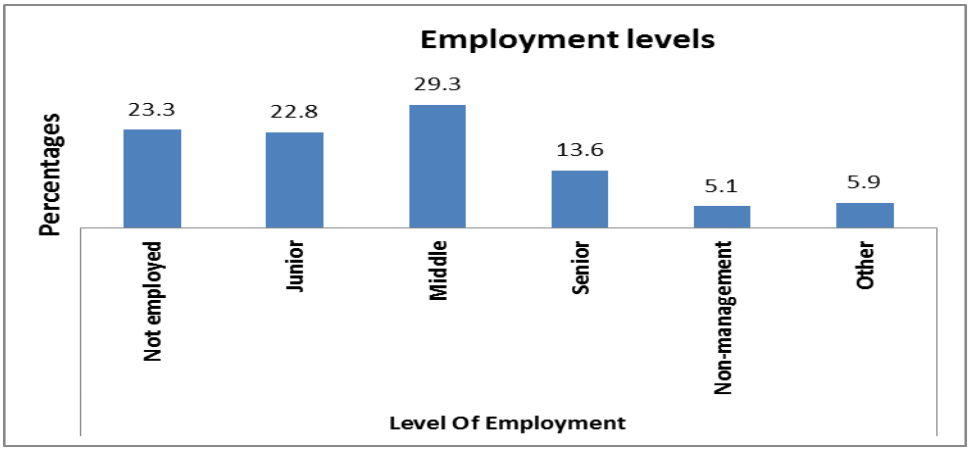

Figure 3.5: Employment levels of participants

When asked about their knowledge of wastewater reuse 39.4% of the respondents indicated that they had little knowledge, while 36.8% indicated that they had sufficient knowledge (Figure 3.6). Those with no knowledge at all consisted of 12.4% of the respondents while the highly knowledgeable respondents were in the minority (11.4%).

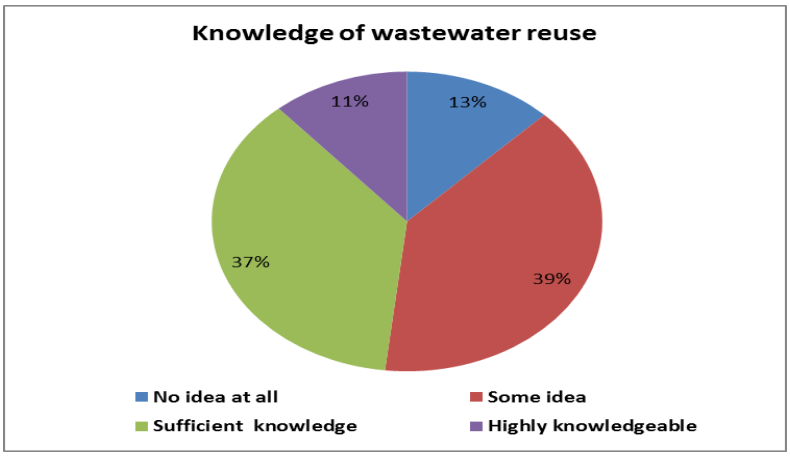

Figure 3.6: Participants' knowledge of wastewater reuse

Figure 3.7 shows the split in participants' knowledge of water scarcity. When asked about their knowledge of water scarcity 39.1% of the respondents indicated that they

had sufficient knowledge, while 31.4% indicated that they had little knowledge. Those who are highly knowledgeable regarding water scarcity consisted of 17.9% of the respondents while those with no knowledge constituted 12.2% of the total respondents.

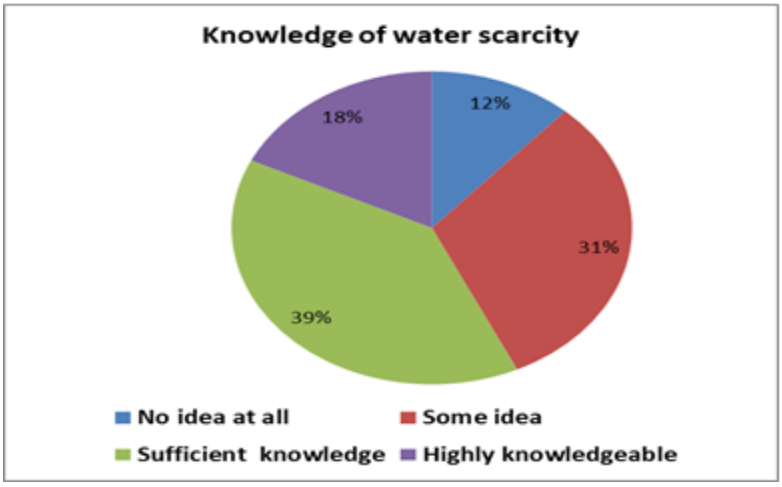

Figure 3.7: Participants' knowledge of wastewater scarcity

3.3 FACTOR ANALYSIS - RELIABILITY

Cronbach's alpha coefficient was used to determine the internal consistency of the questionnaire. The use of Cronbach's alpha coefficient to determine reliability was developed by Lee Cronbach in 1951 in order to check the internal consistency, and is expressed with the number between 0 and 1. According to Tavakol, (2011:53), internal consistency describes the extent to which all items or statements in the test measure the same construct and a reliability estimate expresses the proportion of variability in the measure attributable to the true score. A reliability of 0.5 indicates that about half of the variance of the observed score is attributable to truth and half is attributable to error. For example, reliability of 0.7 means the variability is about 70% true ability and 30% error, and so forth. Reliability of 0.5 and above is acceptable; however reliability of 0.7 and above is ideal. Table 3.1 below illustrates the Cronbach's alpha values for this study.

Table 3.1: Calculated Cronbach's alpha values from the questionnaire

FACTOR	Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
Section B:			
Knowledge of wastewater reuse (B1-B5)	0.507	0.522	5
Wastewater reuse options (B6-B15)	0.801	0.810	10
Section C: Concerns about using wastewater (C1-C5)	0.733	0.733	5
Section D:			
Sources used to access information (D1-D8)	0.6822	0.829	8
Trust in institution's opinions about wastewater reuse (D11-D16)	0.796	0.796	6
Section E: Sources of water to be recycled (E1-E3)	0.716	0.722	3
Section F: Types of water to be recycled (F1-F3)	0.618	0.615	3

Table 3.1 above illustrates the internal consistency of the questionnaire per section. All Cronbach alpha values are higher than 0.50, which shows acceptable levels of reliability. The ideal value as determined by Field (2005:668) is 0.70 and above. Field further mentioned that values less than 0.70 should not be ignored, especially when measuring attitudes, however, when measuring ability, the cut-off point should be 0.70. This study is measuring attitudes; hence values of 0.5 and above are acceptable. The construct; wastewater reuse options showed the highest internal consistency of 0.801, meaning the variability is about 80.1% true ability and 19.9% error. The second highest construct is trust in institution's opinions about wastewater reuse with Cronbach's alpha value of 0.796. Knowledge of wastewater reuse received the lowest value of 0.507, however, still above the minimum cut-off value of 0.50.

3.3 DESCRIPTIVE STATISTICS

3.3.1 Results of the consumer perception survey

The overall results of the research are presented in Table 3.2. The survey questions were developed based on published literature on the perceptions of consumers on

wastewater reuse. The questions in the questionnaire are grouped under themes; however, the response to each question is measured independently.

Table 3.2: Results of the survey on assessing consumer perceptions

Code	Item	% Strongly Disagree	% Disagree	% Neutral	% Agree	% Strongly Agree	# Completed	# missing	mean	STDEV
Reusing wastewater:										
B1	Is environmentally responsible	4.4	6.2	18.3	32.8	36.5	502	13	3.94	1.09
B2	Reduces the amount of pollutants	2.7	10.4	25.7	34.7	26.5	490	25	3.72	1.05
B3	Will cause health concerns	7.8	16.7	25.7	31.6	18.2	490	25	3.36	1.18
B4	Will reduce the need to expand wastewater treatment plants	7.3	15.8	26.6	34.7	15.6	493	22	3.35	1.14
B5	Will bring economic benefit	3.7	5.5	24.2	42	24.6	455	60	3.78	1.00
I will be willing to use treated watewater for the following if such a programme were to be implemented										
B6	Industry use	3.8	4	12.2	34	46	500	15	4.14	1.03
B7	Fire fighting	2.2	4.1	6.9	33.4	53.4	491	24	4.32	0.93
B8	Washing cars	4.4	7.4	14.7	29.3	44.2	502	13	4.02	1.13
B9	Washing clothes	10.2	12	17.7	27.3	32.7	498	17	3.60	1.32
B10	Watering vegetable gardens	7.4	10.6	16.4	29.5	36.1	499	16	3.76	1.25
B11	Watering lawns etc	3.2	4.7	11.9	29.6	50.6	494	21	4.20	1.03
B12	Flushing toilets	5.1	3.9	8.2	26.7	56.1	490	25	4.25	1.09
B13	Cooking food	41.8	16.2	13.7	13.1	15.2	495	20	2.44	1.50
B14	Drinking	40.9	16	15.2	12.2	15.8	501	14	2.46	1.50
B15	Swimming pools	20.6	12.6	24.7	22.5	19.7	462	53	3.08	1.40
I am concerned about using treated wastewater because of:										
C1	Health reasons	7.2	7.6	14.7	26.8	43.7	503	12	3.92	1.24
C2	Psychological reasons	14.2	16.8	31.4	24.7	13	494	21	3.05	1.23
C3	Religious beliefs	31.5	24.8	25	9.8	8.9	492	23	2.40	1.27
C4	I do not trust the workmanship	12	21	27.1	25.3	14.6	499	16	3.09	1.23
C5	Due to fear of mechanical breakdowns	11.8	16.4	28.6	24.4	18.8	483	32	3.22	1.26
I use the following sources to access information about environmental issues:										
D1	Newspapers and magazines	5.6	7	13.6	38.9	34.9	499	16	3.90	1.12
D2	Television	4.2	5.8	11.5	40.2	38.2	497	18	4.02	1.06
D3	Internet	5.1	5.5	14.8	28.5	46.1	492	23	4.05	1.13
D4	Municipal offices/other government agencies	15.4	16.8	23	21.9	23	488	27	3.20	1.37
D5	Universities or other academic institutions	11.1	12.7	23	29.6	23.6	487	28	3.42	1.28
D6	Environmental groups	11.4	16.7	22.7	29.8	19.4	490	25	3.29	1.27
D7	Friends and family	10.6	16.4	26.8	30.1	16.2	482	33	3.25	1.22
D8	Never use any of the mentioned sources	43.5	14.9	16.7	11.7	13.3	377	138	2.36	1.46
I trust the following institution's opinions about wastewater reuse										
D11	Local Municipalities	13.7	14.5	19.9	28.1	23.9	498	17	3.34	1.35
D12	Provincial/National Government	11.6	13	22	31.9	21.5	492	23	3.39	1.28
D13	Water Utilities	4.8	5.4	20.5	37.8	31.5	482	33	3.86	1.07
D14	Experts/ University Professors	4.1	4.1	14.6	36.9	40.4	493	22	4.05	1.04
D15	Media (newspapers, TV)	6.1	13.4	30.5	28.3	21.7	492	23	3.46	1.15
D16	Internet	5.1	11.2	24.3	33.7	25.6	489	26	3.63	1.13
Sources of water to be recyled										
E1	Own household	14.1	11.2	21.7	27.5	25.5	502	13	3.39	1.35
E2	Own neighbourhood	24.4	22.6	26.3	19.8	6.9	495	20	2.62	1.24
E3	Whole city	25.2	22.4	26	19	7.5	496	19	2.61	1.25
Type of water to be recycled										
F1	Rainwater tanks from my own roof to augment water supply	6.5	6.1	14.5	29.9	43	495	20	3.97	1.18
F2	I prefer to use greywater (water from washing clothes, own body, dishes etc.) to augment water supply	17.7	19.9	25.8	23.6	13	492	23	2.94	1.29
F3	I prefer to use wastewater (from wastewater treatment plants) to augment water supply	10.9	15.4	30	29.2	14.4	486	29	3.21	1.19

***Interpretation of the means: 1 = strongly disagree; 2 = Disagree; 3 = Neutral; 4= Agree; 5 = Strongly agree**

Responses to constructs measuring knowledge of wastewater reuse:

Figure 3.8 show that 69.3% agree that reusing wastewater is environmentally responsible; 66.6% indicated that using wastewater will bring economic benefits; 61.2% indicated that amounts of pollutants discharged into the environment will be reduced. Half of the respondents indicated that wastewater reuse will reduce the number of wastewater treatment plants needed and will also cause health concerns. Results in Table 3.2 and Figure 3.8 indicate that on average, the respondents understand the benefits of reusing wastewater.

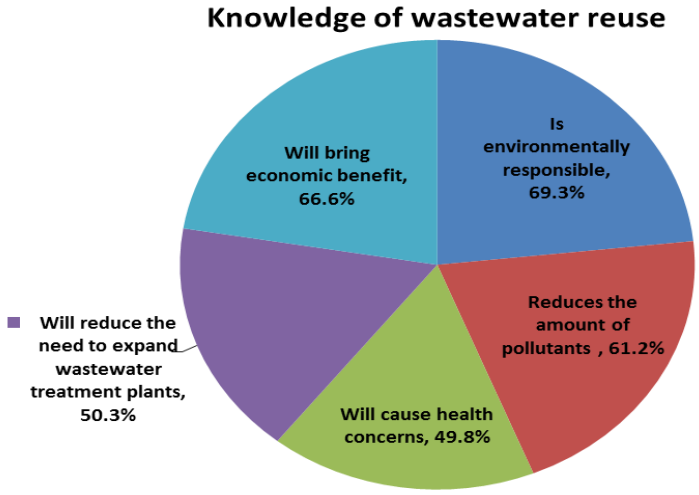

Figure 3.8: Responses to constructs measuring knowledge of wastewater reuse

Wastewater reuse options

Figure 3.9 shows the acceptability of wastewater reuse options. The majority of respondents are willing to use wastewater for industry use (80%), fire fighting (86.8%), washing cars (73.5%), watering lawns and golf courses (80.2%) and flushing toilets (82.8%). The acceptance levels decrease as the human contact increases; this is seen by the decrease in acceptance levels of the following options: watering vegetable gardens (65.6%), washing clothes (60%), swimming pools (42.2%), cooking food (28.3%) and drinking (28%). These findings are in agreement with findings of several

researchers who reported that public acceptance of water reuse is higher when the degree of human contact is minimal (Harley, 2006:116; Robinson *et al*., 2005:61).

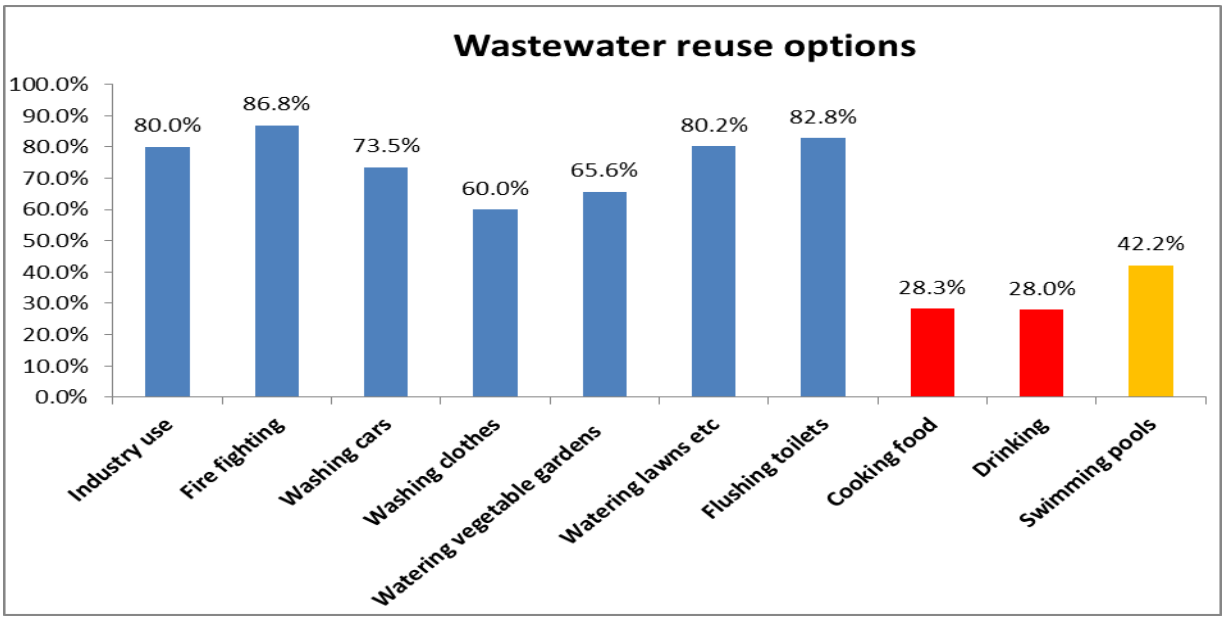

Figure 3.9: Wastewater reuse options

Reasons for not using treated wastewater

Health reasons (70.5%) are the major concern of the respondent regarding wastewater reuse (Figure 3.10). Psychological reasons (37.7%), trust in workmanship (39.9%) and mechanical breakdowns (43.2) were also rated as areas of concern by the respondents. Only 18.7% of the respondents stated that they would not use treated wastewater due to religious beliefs. This is in agreement with the study done in Durban, South Africa by Wilson and Pfaff (2008:1) were no theological and religious objections of wastewater reuse were raised. Studies have shown these stated concerns to be the reason for public resistance to wastewater reuse (Ormerod & Scott, 2012:3; Parkinson, 2008:4; Russell & Lux, 2009:22; Spiegel, 201:2). Trust in the implementing authorities has been found as one of the factors which accept perceptions on wastewater reuse (Adewumi *et al*., 2014:13; Fielding *et al*., 2009:20; Po *et al*., 2005:10; Wilson & Pfaff, 2008:5). These will need to be addressed if wastewater reuse is to be implemented successfully.

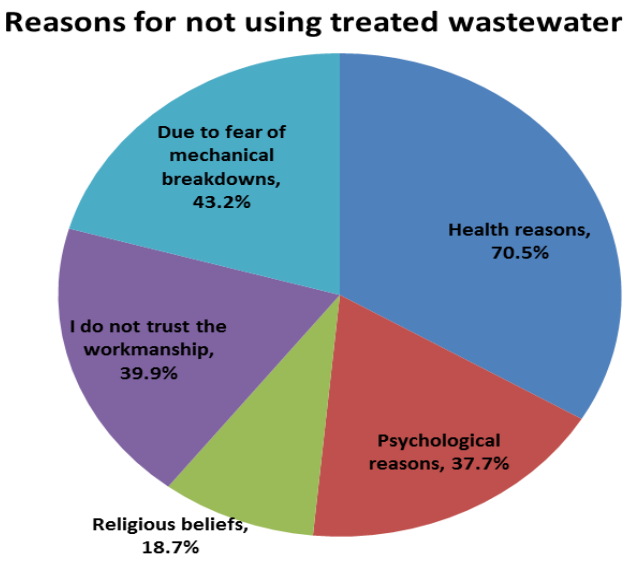

Figure 3.10: Reasons for not using treated wastewater

Sources used to access information on environmental issues

The majority of the respondents indicated that they use television (78.4%) newspapers and magazines (73.8), and internet (74.6%) to get information on environmental issues (Figure 3.11). Some respondents (45-53%) receive information from municipal/government agencies, universities/academic institutions, friends or family and environmental groups. Only 25% of the respondents indicated that they never used the mentioned sources to access information. In the qualitative study some respondents stated that they got information from their places of work as well as in published research papers. These are the information sources that the implementing authorities should use when communicating with the public on any environmental issues including wastewater reuse projects.

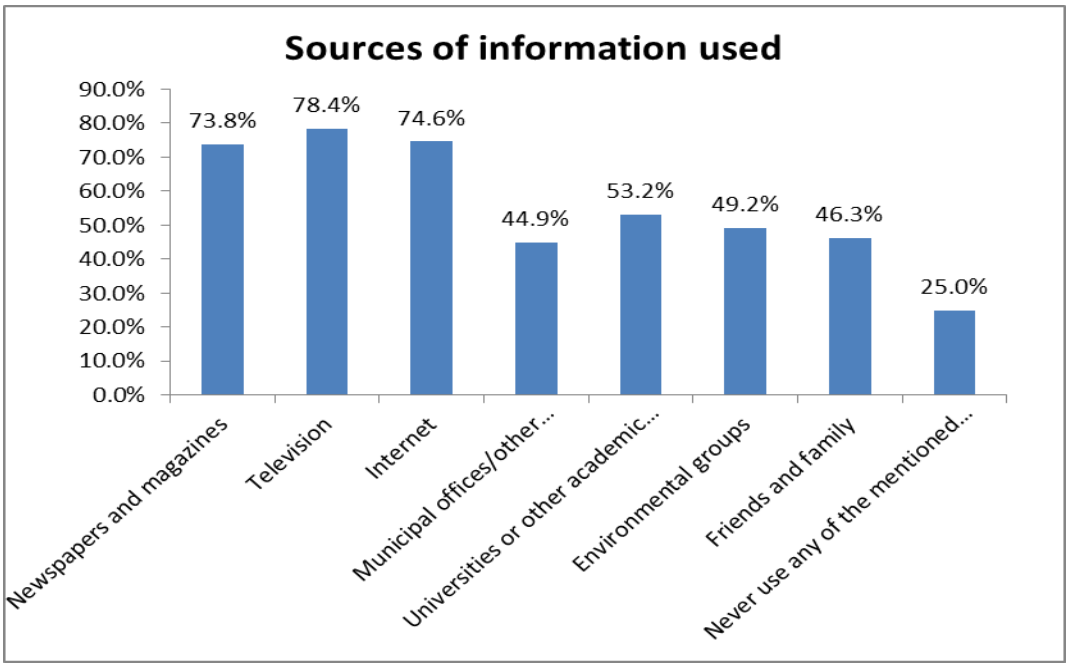

Figure 3.11: Sources used to access information on environmental issues

Trust in institutions' opinions on wastewater reuse

When it comes to trust (Figure 3.12), the majority of respondents clearly trust the water utilities (69.3%) and experts (77.3%) followed by the internet (59.3%). Half of the respondents trust media and local/provincial government. Studies have shown that trust and confidence in public agencies and officials affect the acceptance of wastewater reuse by the public (Dolnicar *et al*., 2011:934; Fielding *et al*., 2009:20; Hurlimann, 2007: 84; Po *et al*., 2005:10). The fact that half of the respondents do not trust their local and provincial governments as well as media needs to be taken in consideration when developing communication strategies.

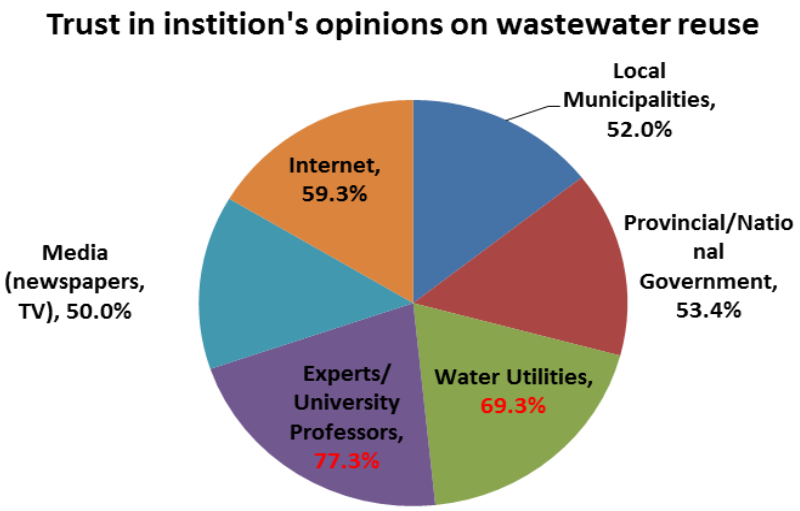

Figure 3.12: Trust in institutions' opinion on wastewater reuse

Sources of water to be recycled

Regarding the sources of water to be recycled (Figure 3.13), 53% of respondents agree when it comes to using wastewater from their own households. The majority of the respondents disagree to using water from the neighbourhood or whole city. Additionally, respondents are neutral towards using grey water or wastewater from treatment plants. Rainwater harvesting is preferred.

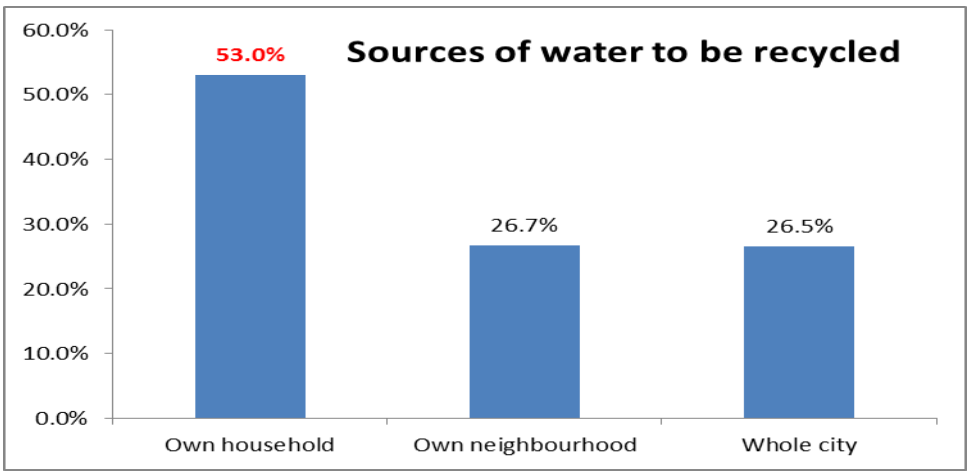

Figure 3.13: Sources of water to be recycled

3.3 T-TEST, ANOVA AND EFFECT SIZE

An independent T-test and ANOVA are statistical tests used to determine the impact of a study by looking at statistical significances between the measured groups. In order to use the t-test and ANOVA test the data needs to represent a random ample from a population that is normally distributed (Levine *et al*., 2011:340). A convenience sample was used in this study and not a random sample; as a result p-values (from an independent t-test and ANOVA test) will be reported for completeness and will not be interpreted.

- *Effect size*

An effect size is a measure that describes the magnitude of the difference between two groups. An effect size is calculated by taking the difference in means between two groups and dividing that number by their combined (pooled) standard deviation. Effect sizes are valuable in research because they represent a standard measure by which outcomes can be assessed. Statistical significance (t-test and ANOVA) can be used to determine whether a study had an effect; however, statistical significance is heavily dependent upon sample size, hence it is not a good measure of an effect. What matters most in a study is not statistical significance, but, whether the size of an effect is meaningful the concept of effect size is used to determine this (Cohen, 1988; Ellis & Steyn, 2003).

Practical significant (effect size) differences between the means are interpreted as follows:

- d ~ 0.2 indicates a Small or No practically significant difference
- d ~ 0.5 indicates a Medium or Practically visible difference
- d ~ 0.8 indicates a Large or Practically significant difference

In this study an effect size analysis is conducted to ascertain whether differences in gender, age group, race, level of employment, qualification, knowledge of wastewater reuse and knowledge of water scarcity result in different opinions/ perceptions.

3.3.1 Gender

A practical significance test (effect size) is used to assess whether the opinions of males and females differ since a convenience sample was used (Ellis & Steyn, 2003). The results obtained for differences in opinions based on gender are indicated in Table 3.3.

Results indicate that no practically significant differences were obtained on most statements when comparing responses of males to those of the females except for:

- A small to medium difference (d = 0.31) were indicated for trust in local municipalities (D11) where on average the males' response was neutral and the females' was neutral to agree and
- Use of wastewater from the whole city (E3) (d = 0.33), the males' response was disagree to neutral and the females' was mostly disagree.

The rest of the effect sizes are small, hence it can be concluded that there are no practically significant differences between the opinions of the males to the opinions of the females regarding wastewater reuse.

Overall mean scores for wastewater reuse options indicate that both males and females felt unfavourable toward use of wastewater for cooking and drinking and favourable towards other uses with minimal human contact as has been reported in literature (Robinson *et al*., 2005:62; Vedachalam & Mancl, 2010:111). Additionally literature indicates that males are more positive about wastewater reuse than females (Dolnicar & Schafer, 2009:888; Hurlimann, 2007:60) which is contrary to the findings of this study which found no significant differences between the perceptions of males and females.

Table 3.3: T-test results indicating differences in opinions based on gender

A1: GENDER		N	Mean	Std. Deviation	p-value (t-test)	Effect size	Interpretation
B1	Males	240	3.95	1.118	.799	0.02	Agree
	Females	254	3.93	1.065			
B2	Males	236	3.74	1.067	.895	0.01	Agree
	Females	247	3.72	1.035			
B3	Males	237	3.32	1.188	.620	0.04	Neural
	Females	246	3.37	1.180			
B4	Males	239	3.31	1.186	.327	0.09	Neutral
	Females	246	3.41	1.083			
B5	Males	222	3.73	.979	.298	0.10	Agree
	Females	227	3.83	1.023			
B6	Males	243	4.23	1.026	.069	0.16	Agree
	Females	249	4.06	1.042			
B7	Males	239	4.30	.983	.692	0.03	Agree
	Females	245	4.33	.878			
B8	Males	243	3.96	1.198	.268	0.09	Agree
	Females	251	4.07	1.060			
B9	Males	242	3.64	1.320	.548	0.05	Neutral to agree
	Females	248	3.57	1.330			
B10	Males	240	3.78	1.257	.818	0.02	Neutral to agree
	Females	251	3.75	1.241			
B11	Males	241	4.22	1.037	.570	0.05	Agree
	Females	246	4.17	1.036			
B12	Males	237	4.30	1.042	.240	0.10	Agree
	Females	247	4.19	1.150			
B13	Males	240	2.53	1.508	.202	0.11	Disagree
	Females	250	2.36	1.493			
B14	Males	242	2.58	1.506	.065	0.17	Disagree
	Females	252	2.33	1.486			
B15	Males	223	3.18	1.416	.162	0.13	Neutral
	Females	234	3.00	1.388			
C1	Males	244	3.84	1.298	.150	0.12	Agree
	Females	251	4.00	1.171			
C2	Males	240	3.12	1.263	.234	0.11	Neutral
	Females	246	2.99	1.197			
C3	Males	239	2.37	1.279	.809	0.02	Disagree
	Females	245	2.40	1.242			
C4	Males	243	3.12	1.299	.650	0.04	Neutral
	Females	247	3.07	1.163			
C5	Males	230	3.13	1.326	.205	0.11	Neutral
	Females	245	3.28	1.194			

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

****Interpretation of the means: 1 = strongly disagree; 2 = Disagree; 3 = Neutral; 4= Agree; 5 = Strongly Agree***

Table 3.3 continued

A1: GENDER		N	Mean	Std. Deviation	p-value (t-test)	Effect size	Interpretation
D1	Males	240	3.91	1.137	.666	0.04	Agree
	Females	251	3.87	1.118			
D2	Males	239	4.01	1.085	.937	0.01	Agree
	Females	250	4.02	1.033			
D3	Males	237	4.05	1.094	.828	0.02	Agree
	Females	247	4.03	1.179			
D4	Males	235	3.21	1.367	.812	0.02	Neutral
	Females	246	3.18	1.380			
D5	Males	235	3.49	1.252	.191	0.12	Neutral
	Females	244	3.33	1.305			
D6	Males	237	3.36	1.239	.194	0.12	Neutral
	Females	245	3.21	1.300			
D7	Males	232	3.31	1.227	.191	0.12	Neutral
	Females	243	3.17	1.199			
D8	Males	187	2.22	1.455	.107	0.17	Disagree
	Females	184	2.46	1.437			
D11	Males	241	3.12	1.387	.000	0.31	Neutral
	Females	249	3.55	1.273			
D12	Males	240	3.25	1.312	.028	0.19	Neutral
	Females	244	3.51	1.219			
D13	Males	236	3.77	1.134	.078	0.15	Agree
	Females	237	3.94	1.007			
D14	Males	240	4.13	1.011	.104	0.14	Agree
	Females	246	3.97	1.063			
D15	Males	239	3.46	1.151	.853	0.02	Neutral
	Females	245	3.44	1.146			
D16	Males	235	3.63	1.160	.971	0.00	Neutral
	Females	246	3.63	1.106			
E1	Males	241	3.31	1.341	.148	0.13	Neutral
	Females	253	3.48	1.347			
E2	Males	239	2.72	1.251	.115	0.14	Disagree
	Females	249	2.54	1.228			
E3	Males	240	2.84	1.282	.000	0.33	Disagree
	Females	249	2.41	1.198			
F1	Males	240	3.95	1.179	.509	0.06	Agree
	Females	249	4.02	1.171			
F2	Males	236	2.98	1.309	.640	0.04	Disagree
	Females	250	2.92	1.270			
F3	Males	236	3.19	1.213	.609	0.05	Neutral
	Females	244	3.24	1.160			

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

****Interpretation of the means: 1 = strongly disagree; 2 = Disagree; 3 = Neutral; 4= Agree; 5 = Strongly Agree***

3.3.2 Age group

The results of perceptions of different age groups are indicated in Table 3.4a. Results indicate that, on average, there are no practically significant differences in the responses of different age groups for questions either than B6, B8, B11 and F2.

Medium or practically visible differences were obtained for questions B6, B8, B11 and F2 (Table 3.4b). These results indicate that there are differences in opinions of people less than 21 years old and the other age groups. The responses of respondents who are less than 21 years old was neutral to agree when asked on their willingness to use wastewater for industry, washing cars and watering lawns and golf courses whereas other age groups agreed to these reuse options (B6, B8 and B11). When asked about their willingness to use grey water the respondents who are less than 21 years old disagreed; however, other age groups' responses were neutral. These results indicate that respondents who are less than 21 years old tend to have negative perceptions on wastewater reuse, an indication that strategies for managing the perceptions should address these two age group categories individually.

Age has been found as one of the most frequently found factors associated with acceptance of wastewater reuse (Alhumoud & Madzikanda, 2010:147; Dolnicar & Saunders, 2005:184). These results show that younger people (<21 years old) are more prone to negative perceptions on wastewater reuse than the older groups (Table 3.4b). Older respondents were found to have favourable attitudes towards wastewater reuse in the studies done by Hurlimann, (2007:58) and Dolnicar and Schafer (2009:890).

Table 3.4a: Descriptive statistics and effect size results for age groups

A2: AGE GROUP		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							< 21 with	21 - 30 with ..	31 - 40 with ...	41 - 50 with
B1	<21	63	3.76	1.118						
	21-30	131	4.02	1.011			0.23			
	31-40	161	3.99	1.084	0.571	0.583	0.20	0.03		
	41-50	88	3.92	1.116			0.14	0.09	0.06	
	>50	48	3.88	1.248			0.09	0.12	0.09	0.04
	Total	491	3.95	1.091						
B2	<21	61	3.49	1.059						
	21-30	130	3.75	1.006			0.24			
	31-40	157	3.87	1.024	0.090	0.116	0.36	0.12		
	41-50	86	3.76	1.028			0.25	0.01	0.11	
	>50	46	3.52	1.169			0.03	0.19	0.30	0.20
	Total	480	3.74	1.043						
B3	<21	59	3.54	1.104						
	21-30	131	3.40	1.114			0.13			
	31-40	159	3.18	1.185	0.254	0.246	0.30	0.18		
	41-50	84	3.43	1.245			0.09	0.03	0.20	
	>50	47	3.36	1.309			0.14	0.03	0.14	0.05
	Total	480	3.35	1.181						
B4	<21	62	3.23	1.165						
	21-30	129	3.30	1.143			0.07			
	31-40	160	3.46	1.143	0.665	0.678	0.20	0.13		
	41-50	85	3.38	1.080			0.13	0.06	0.07	
	>50	46	3.33	1.194			0.08	0.02	0.11	0.04
	Total	482	3.36	1.138						
B5	<21	57	3.49	1.167						
	21-30	126	3.83	.980			0.29			
	31-40	152	3.83	.995	0.243	0.390	0.29	0.00		
	41-50	77	3.82	.996			0.28	0.01	0.01	
	>50	36	3.81	.822			0.27	0.02	0.02	0.01
	Total	448	3.78	1.004						
B6	<21	62	3.81	.989						
	21-30	133	4.20	1.057			0.38			
	31-40	160	4.13	1.086	0.035	0.030	0.29	0.07		
	41-50	87	4.23	.845			0.43	0.03	0.10	
	>50	47	4.38	1.033			0.56	0.17	0.24	0.15
	Total	489	4.15	1.028						
B7	<21	59	4.19	.900						
	21-30	131	4.34	.926			0.17			
	31-40	159	4.32	.916	0.647	0.637	0.15	0.02		
	41-50	84	4.42	.824			0.26	0.08	0.10	
	>50	47	4.28	1.117			0.08	0.06	0.04	0.13
	Total	480	4.32	.922						
B8	<21	62	3.60	1.137						
	21-30	133	4.00	1.148			0.35			
	31-40	160	4.13	1.076	0.036	0.038	0.47	0.11		
	41-50	88	4.05	1.144			0.39	0.04	0.08	
	>50	48	4.08	1.235			0.39	0.07	0.04	0.03
	Total	491	4.01	1.139						
B9	<21	61	3.08	1.394						
	21-30	132	3.57	1.303			0.35			
	31-40	160	3.71	1.261	0.024	0.039	0.45	0.11		
	41-50	86	3.70	1.302			0.44	0.10	0.01	
	>50	48	3.69	1.446			0.42	0.08	0.02	0.01
	Total	487	3.59	1.325						
B10	<21	61	3.39	1.345						
	21-30	133	3.71	1.254			0.23			
	31-40	160	3.84	1.226	0.093	0.124	0.33	0.11		
	41-50	86	3.77	1.214			0.28	0.05	0.06	
	>50	48	4.00	1.203			0.45	0.23	0.13	0.19
	Total	488	3.75	1.250						
B11	<21	61	3.67	1.136						
	21-30	129	4.22	1.060			0.48			
	31-40	160	4.32	.934	0.000	0.002	0.57	0.10		
	41-50	85	4.20	1.021			0.46	0.02	0.12	
	>50	48	4.40	.939			0.64	0.17	0.08	0.19
	Total	483	4.20	1.029						
B12	<21	60	4.02	1.157						
	21-30	131	4.16	1.214			0.12			
	31-40	158	4.37	.994	0.070	0.048	0.31	0.18		
	41-50	83	4.13	1.166			0.10	0.02	0.21	
	>50	47	4.49	.856			0.41	0.27	0.12	0.31
	Total	479	4.24	1.103						
B13	<21	58	2.41	1.633						
	21-30	134	2.32	1.500			0.06			
	31-40	160	2.51	1.432	0.652	0.660	0.06	0.12		
	41-50	85	2.58	1.538			0.10	0.17	0.05	
	>50	48	2.27	1.540			0.09	0.03	0.15	0.20
	Total	485	2.43	1.503						
B14	<21	63	2.40	1.561						
	21-30	133	2.29	1.510			0.07			
	31-40	160	2.54	1.444	0.260	0.278	0.09	0.17		
	41-50	87	2.69	1.543			0.19	0.26	0.09	
	>50	47	2.26	1.510			0.09	0.02	0.19	0.28
	Total	490	2.45	1.504						
B15	<21	60	3.07	1.448						
	21-30	126	2.94	1.301			0.09			
	31-40	148	3.24	1.337	0.448	0.421	0.12	0.22		
	41-50	83	3.11	1.514			0.03	0.11	0.08	
	>50	38	2.92	1.600			0.09	0.01	0.20	0.12
	Total	455	3.08	1.399						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.4a continued

	A2: AGE GROUP	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							< 21 with	21 - 30 with ..	31 - 40 with ...	41 - 50 with
C1	<21	64	3.73	1.324						
	21-30	134	4.05	1.165			0.24			
	31-40	159	3.82	1.245	0.315	0.332	0.07	0.18		
	41-50	84	4.02	1.212			0.22	0.02	0.16	
	>50	50	4.00	1.278			0.20	0.04	0.14	0.02
	Total	491	3.93	1.233						
C2	<21	62	3.10	1.155						
	21-30	133	3.29	1.186			0.17			
	31-40	155	2.94	1.244	0.054	0.056	0.12	0.28		
	41-50	83	2.92	1.251			0.14	0.30	0.02	
	>50	49	2.82	1.269			0.22	0.38	0.10	0.08
	Total	482	3.04	1.228						
C3	<21	62	2.71	1.311						
	21-30	132	2.47	1.322			0.18			
	31-40	155	2.24	1.212	0.139	0.156	0.36	0.17		
	41-50	83	2.36	1.235			0.27	0.08	0.10	
	>50	48	2.31	1.206			0.30	0.12	0.06	0.04
	Total	480	2.39	1.263						
C4	<21	62	2.84	1.162						
	21-30	132	3.10	1.197			0.22			
	31-40	158	3.13	1.242	0.238	0.250	0.24	0.03		
	41-50	85	2.98	1.253			0.11	0.10	0.12	
	>50	50	3.34	1.319			0.38	0.18	0.16	0.28
	Total	487	3.08	1.232						
C5	<21	60	3.02	1.200						
	21-30	127	3.17	1.267			0.12			
	31-40	156	3.24	1.276	0.715	0.694	0.17	0.05		
	41-50	79	3.28	1.270			0.21	0.08	0.03	
	>50	49	3.31	1.228			0.24	0.10	0.05	0.02
	Total	471	3.21	1.256						
D1	<21	62	3.69	1.313						
	21-30	133	3.77	1.063			0.06			
	31-40	157	4.08	.993	0.085	0.073	0.30	0.29		
	41-50	85	3.92	1.147			0.17	0.12	0.14	
	>50	50	3.82	1.304			0.10	0.03	0.20	0.07
	Total	487	3.89	1.123						
D2	<21	61	4.07	1.138						
	21-30	133	3.89	1.105			0.16			
	31-40	157	4.07	.948	0.419	0.444	0.00	0.17		
	41-50	85	4.13	.997			0.06	0.22	0.06	
	>50	49	3.92	1.239			0.12	0.03	0.12	0.17
	Total	485	4.01	1.057						
D3	<21	59	3.88	1.314						
	21-30	131	4.12	1.144			0.18			
	31-40	156	4.16	1.025	0.235	0.255	0.21	0.03		
	41-50	86	3.88	1.162			0.00	0.21	0.24	
	>50	49	3.94	1.197			0.04	0.15	0.18	0.05
	Total	481	4.04	1.140						
D4	<21	62	3.34	1.390						
	21-30	131	3.16	1.352			0.13			
	31-40	150	3.21	1.359	0.824	0.825	0.09	0.04		
	41-50	84	3.07	1.360			0.19	0.07	0.10	
	>50	49	3.24	1.479			0.06	0.06	0.02	0.12
	Total	476	3.19	1.371						
D5	<21	59	3.37	1.244						
	21-30	127	3.40	1.268			0.02			
	31-40	155	3.37	1.294	0.813	0.815	0.00	0.03		
	41-50	85	3.42	1.294			0.04	0.02	0.04	
	>50	50	3.62	1.276			0.19	0.17	0.19	0.15
	Total	476	3.41	1.276						
D6	<21	60	3.25	1.398						
	21-30	131	3.24	1.258			0.01			
	31-40	152	3.34	1.250	0.906	0.905	0.06	0.08		
	41-50	85	3.21	1.226			0.03	0.02	0.10	
	>50	50	3.38	1.308			0.09	0.11	0.03	0.13
	Total	478	3.28	1.269						
D7	<21	61	2.93	1.389						
	21-30	129	3.38	1.055			0.32			
	31-40	154	3.32	1.198	0.067	0.082	0.28	0.05		
	41-50	81	3.02	1.183			0.06	0.30	0.25	
	>50	47	3.26	1.406			0.23	0.09	0.04	0.16
	Total	472	3.23	1.213						
D8	<21	46	2.57	1.500						
	21-30	90	2.11	1.378			0.30			
	31-40	127	2.24	1.461	0.060	0.083	0.22	0.09		
	41-50	64	2.34	1.348			0.15	0.17	0.07	
	>50	40	2.85	1.528			0.19	0.48	0.40	0.33
	Total	367	2.33	1.444						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.4a continued

	A2: AGE GROUP	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							< 21 with	21 - 30 with ..	31 - 40 with ...	41 - 50 with
D11	<21	63	3.68	1.090						
	21-30	130	3.38	1.302			0.23			
	31-40	158	3.28	1.345	0.149	0.090	0.30	0.07		
	41-50	86	3.23	1.436			0.31	0.10	0.04	
	>50	49	3.08	1.566			0.38	0.19	0.13	0.10
	Total	486	3.33	1.348						
D12	<21	62	3.63	1.204						
	21-30	128	3.50	1.217			0.11			
	31-40	157	3.41	1.209	0.048	0.084	0.18	0.08		
	41-50	84	3.18	1.355			0.33	0.24	0.17	
	>50	49	3.02	1.507			0.40	0.32	0.26	0.10
	Total	480	3.38	1.277						
D13	<21	57	3.65	1.203						
	21-30	127	3.98	1.027			0.27			
	31-40	155	3.99	1.063	0.026	0.037	0.28	0.01		
	41-50	81	3.70	1.006			0.05	0.27	0.27	
	>50	49	3.57	1.155			0.06	0.35	0.36	0.11
	Total	469	3.85	1.080						
D14	<21	62	3.69	1.236						
	21-30	129	4.12	.960			0.35			
	31-40	156	4.15	.998	0.042	0.103	0.37	0.03		
	41-50	84	3.98	1.097			0.23	0.13	0.16	
	>50	50	4.04	.968			0.28	0.09	0.11	0.06
	Total	481	4.04	1.043						
D15	<21	61	3.25	1.312						
	21-30	129	3.42	1.044			0.13			
	31-40	156	3.51	1.139	0.615	0.698	0.20	0.08		
	41-50	85	3.47	1.171			0.17	0.04	0.03	
	>50	49	3.53	1.174			0.22	0.10	0.02	0.05
	Total	480	3.45	1.146						
D16	<21	63	3.51	1.330						
	21-30	128	3.66	1.138			0.12			
	31-40	156	3.74	1.015	0.354	0.348	0.18	0.07		
	41-50	84	3.48	1.146			0.02	0.16	0.23	
	>50	46	3.52	1.110			0.01	0.13	0.20	0.04
	Total	477	3.62	1.127						
E1	<21	62	3.45	1.387						
	21-30	132	3.43	1.243			0.01			
	31-40	160	3.49	1.392	0.547	0.576	0.03	0.04		
	41-50	87	3.24	1.381			0.15	0.14	0.18	
	>50	49	3.20	1.384			0.18	0.16	0.20	0.03
	Total	490	3.40	1.348						
E2	<21	61	2.39	1.100						
	21-30	132	2.81	1.303			0.32			
	31-40	157	2.71	1.252	0.068	0.060	0.25	0.08		
	41-50	86	2.51	1.244			0.10	0.23	0.16	
	>50	48	2.35	1.158			0.03	0.35	0.28	0.13
	Total	484	2.63	1.244						
E3	<21	61	2.36	1.096						
	21-30	132	2.69	1.291			0.25			
	31-40	158	2.75	1.245	0.147	0.125	0.32	0.05		
	41-50	86	2.52	1.272			0.13	0.13	0.18	
	>50	48	2.40	1.317			0.03	0.22	0.27	0.10
	Total	485	2.61	1.256						
F1	<21	57	3.77	1.350						
	21-30	132	4.02	1.056			0.18			
	31-40	158	4.02	1.143	0.159	0.250	0.18	0.00		
	41-50	87	4.16	1.130			0.29	0.13	0.12	
	>50	50	3.72	1.386			0.04	0.21	0.22	0.32
	Total	484	3.98	1.174						
F2	<21	60	2.52	1.295						
	21-30	129	3.04	1.240			0.40			
	31-40	158	3.13	1.305	0.017	0.022	0.47	0.07		
	41-50	85	2.99	1.286			0.36	0.04	0.11	
	>50	49	2.71	1.291			0.15	0.25	0.32	0.21
	Total	481	2.96	1.293						
F3	<21	58	3.28	1.225						
	21-30	128	3.25	1.236			0.02			
	31-40	157	3.31	1.125	0.531	0.534	0.02	0.05		
	41-50	83	3.07	1.228			0.17	0.14	0.19	
	>50	49	3.06	1.180			0.18	0.15	0.21	0.01
	Total	475	3.22	1.190						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.4b: Descriptive statistics and medium to large effect size for age groups

A2: AGE GROUP		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							< 21 with	21 - 30 with ..	31 - 40 with ...	41 - 50 with
B6	<21	62	3.81	.989	0.035	0.030				
	21-30	133	4.20	1.057			0.38			
	31-40	160	4.13	1.086			0.29	0.07		
	41-50	87	4.23	.845			0.43	0.03	0.10	
	>50	47	4.38	1.033			0.56	0.17	0.24	0.15
	Total	489	4.15	1.028						
B8	<21	62	3.60	1.137	0.036	0.038				
	21-30	133	4.00	1.148			0.35			
	31-40	160	4.13	1.076			0.47	0.11		
	41-50	88	4.05	1.144			0.39	0.04	0.08	
	>50	48	4.08	1.235			0.39	0.07	0.04	0.03
	Total	491	4.01	1.139						
B11	<21	61	3.67	1.136	0.000	0.002				
	21-30	129	4.22	1.060			0.48			
	31-40	160	4.32	.934			0.57	0.10		
	41-50	85	4.20	1.021			0.46	0.02	0.12	
	>50	48	4.40	.939			0.64	0.17	0.08	0.19
	Total	483	4.20	1.029						
F2	<21	60	2.52	1.295	0.017	0.022				
	21-30	129	3.04	1.240			0.40			
	31-40	158	3.13	1.305			0.47	0.07		
	41-50	85	2.99	1.286			0.36	0.04	0.11	
	>50	49	2.71	1.291			0.15	0.25	0.32	0.21
	Total	481	2.96	1.293						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.3.3 Race

Tables 3.5a & b show the results of perceptions of different race groups. The effect size results indicate that there are some similarities in opinions of respondents belonging to different race groups as well as some differences in opinions (Table 3.5a). Large or practically significant differences were observed on questions D8, D11 and D12 which measure trust of respondents in local municipalities and Provincial or National government (Table 3.5b). The average response of Black and Coloured respondents is neutral to agree on these questions whereas the White respondents do not trust their local municipalities and Provincial or National government. These will need to be addressed if wastewater reuse is to be implemented successfully.

Medium or practically visible differences were also observed between respondents of different races on questions B8, B15, C3, C4, D1, D4, D6, D7, D11, D13 and F3 (Table 3.5b). These results indicate that race influences the perceptions on wastewater as has been found in literature (Alhumoud & Madzikanda 2010:150; Dishman *et al*., 2009:157) and hence could be a barrier during implementation of wastewater projects.

Table 3.5a: Descriptive statistics and effect size results based on race

A3: RACE		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B1	Blacks	381	3.93	1.077					
	Coloureds	22	3.64	1.329			0.22		
	Indians	21	3.90	1.261	.507	.615	0.02	0.20	
	Whites	67	4.04	1.051			0.11	0.31	0.11
	Total	491	3.93	1.093					
B2	Blacks	372	3.78	1.025					
	Coloureds	22	3.32	1.041			0.44		
	Indians	20	3.35	1.137	.052	.081	0.38	0.03	
	Whites	66	3.61	1.108			0.16	0.26	0.23
	Total	480	3.72	1.047					
B3	Blacks	371	3.35	1.215					
	Coloureds	22	3.18	1.006			0.13		
	Indians	21	3.14	1.014	.521	.450	0.17	0.04	
	Whites	67	3.51	1.146			0.13	0.28	0.32
	Total	481	3.35	1.188					
B4	Blacks	374	3.36	1.133					
	Coloureds	21	3.24	.944			0.11		
	Indians	21	3.29	1.309	.951	.936	0.06	0.04	
	Whites	66	3.38	1.200			0.01	0.12	0.07
	Total	482	3.36	1.140					
B5	Blacks	367	3.77	1.013					
	Coloureds	13	3.46	1.127			0.27		
	Indians	11	3.73	1.191	.351	.323	0.03	0.22	
	Whites	55	3.96	.816			0.20	0.45	0.20
	Total	446	3.78	.999					
B6	Blacks	381	4.07	1.059					
	Coloureds	20	4.05	1.234			0.01		
	Indians	21	4.33	.856	.027	.010	0.25	0.23	
	Whites	67	4.46	.823			0.37	0.33	0.15
	Total	489	4.13	1.037					
B7	Blacks	370	4.26	.933					
	Coloureds	22	4.18	1.259			0.06		
	Indians	21	4.62	.590	.081	.029	0.39	0.35	
	Whites	67	4.51	.911			0.27	0.26	0.12
	Total	480	4.31	.939					
B8	Blacks	381	3.94	1.159					
	Coloureds	22	4.09	1.192			0.13		
	Indians	21	4.48	.602	.094	.005	0.47	0.32	
	Whites	67	4.16	1.081			0.20	0.06	0.29
	Total	491	4.00	1.137					
B9	Blacks	377	3.53	1.343					
	Coloureds	22	4.00	1.113			0.35		
	Indians	21	3.90	1.179	.221	.155	0.28	0.08	
	Whites	67	3.67	1.342			0.11	0.24	0.17
	Total	487	3.58	1.329					
B10	Blacks	378	3.74	1.237					
	Coloureds	22	4.14	1.082			0.32		
	Indians	21	3.86	1.236	.381	.327	0.09	0.23	
	Whites	67	3.61	1.392			0.09	0.38	0.18
	Total	488	3.75	1.253					
B11	Blacks	375	4.09	1.082					
	Coloureds	22	4.23	1.020			0.12		
	Indians	20	4.55	.686	.003	.000	0.42	0.32	
	Whites	66	4.56	.726			0.43	0.33	0.01
	Total	483	4.18	1.037					
B12	Blacks	370	4.16	1.144					
	Coloureds	22	4.32	.995			0.14		
	Indians	20	4.50	.827	.019	.006	0.30	0.18	
	Whites	67	4.58	.838			0.37	0.27	0.10
	Total	479	4.24	1.097					
B13	Blacks	377	2.42	1.500					
	Coloureds	22	2.36	1.529			0.03		
	Indians	19	2.63	1.499	.912	.915	0.14	0.18	
	Whites	67	2.49	1.511			0.05	0.08	0.09
	Total	485	2.43	1.499					
B14	Blacks	381	2.46	1.512					
	Coloureds	22	2.45	1.595			0.00		
	Indians	20	2.55	1.504	.965	.963	0.06	0.06	
	Whites	67	2.37	1.434			0.06	0.05	0.12
	Total	490	2.45	1.501					
B15	Blacks	364	3.06	1.398					
	Coloureds	15	3.40	1.298			0.24		
	Indians	17	3.71	1.404	.130	.154	0.46	0.22	
	Whites	58	2.86	1.382			0.14	0.39	0.60
	Total	454	3.07	1.397					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.5a continued

A3: RACE		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
C1	Blacks	378	3.88	1.246					
	Coloureds	23	4.00	1.206			0.10		
	Indians	20	3.85	1.137	.835	.838	0.02	0.12	
	Whites	70	4.01	1.245			0.11	0.01	0.13
	Total	491	3.90	1.238					
C2	Blacks	369	3.08	1.223					
	Coloureds	23	2.87	1.140			0.18		
	Indians	20	3.05	.999	.689	.701	0.03	0.16	
	Whites	70	2.93	1.311			0.12	0.04	0.09
	Total	482	3.05	1.222					
C3	Blacks	369	2.39	1.273					
	Coloureds	23	2.74	1.176			0.27		
	Indians	20	2.65	1.226	.160	.146	0.20	0.07	
	Whites	68	2.15	1.188			0.19	0.50	0.41
	Total	480	2.39	1.258					
C4	Blacks	374	2.93	1.188					
	Coloureds	23	3.04	1.224			0.09		
	Indians	19	3.37	1.065	.000	.000	0.37	0.27	
	Whites	70	3.83	1.227			0.73	0.64	0.37
	Total	486	3.08	1.229					
C5	Blacks	362	3.11	1.264					
	Coloureds	23	3.13	1.290			0.02		
	Indians	20	3.65	.813	.029	.011	0.43	0.40	
	Whites	67	3.52	1.248			0.33	0.30	0.10
	Total	472	3.19	1.256					
D1	Blacks	376	3.87	1.138					
	Coloureds	23	4.39	.941			0.46		
	Indians	20	4.05	1.146	.137	.077	0.16	0.30	
	Whites	68	3.79	1.100			0.07	0.54	0.22
	Total	487	3.89	1.128					
D2	Blacks	374	4.07	.993					
	Coloureds	23	4.04	1.296			0.02		
	Indians	20	3.70	1.342	.052	.128	0.28	0.26	
	Whites	68	3.74	1.192			0.28	0.24	0.03
	Total	485	4.01	1.059					
D3	Blacks	371	3.99	1.173					
	Coloureds	23	4.30	1.063			0.27		
	Indians	20	4.25	.967	.390	.340	0.22	0.05	
	Whites	68	4.13	1.021			0.12	0.16	0.12
	Total	482	4.04	1.140					
D4	Blacks	367	3.24	1.326					
	Coloureds	23	3.74	1.356			0.37		
	Indians	20	3.30	1.490	.002	.007	0.04	0.29	
	Whites	68	2.65	1.443			0.41	0.76	0.44
	Total	478	3.18	1.369					
D5	Blacks	367	3.32	1.254					
	Coloureds	22	3.91	1.306			0.45		
	Indians	20	3.85	1.182	.046	.058	0.42	0.05	
	Whites	66	3.52	1.384			0.14	0.28	0.24
	Total	475	3.40	1.279					
D6	Blacks	367	3.21	1.248					
	Coloureds	23	3.91	1.276			0.55		
	Indians	20	3.80	1.152	.014	.019	0.48	0.09	
	Whites	68	3.19	1.352			0.01	0.53	0.45
	Total	478	3.26	1.271					
D7	Blacks	364	3.19	1.194					
	Coloureds	22	3.86	1.125			0.56		
	Indians	20	3.35	1.309	.085	.075	0.12	0.39	
	Whites	65	3.23	1.272			0.03	0.50	0.09
	Total	471	3.23	1.212					
D8	Blacks	280	2.20	1.364					
	Coloureds	17	3.59	1.583			0.87		
	Indians	17	2.76	1.678	.001	.007	0.33	0.49	
	Whites	53	2.45	1.526			0.16	0.72	0.19
	Total	367	2.33	1.442					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.5a continued

A3: RACE		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
D11	Blacks	377	3.56	1.228					
	Coloureds	22	3.32	1.359			0.18		
	Indians	20	3.00	1.214	.000	.000	0.46	0.23	
	Whites	67	2.10	1.316			1.11	0.89	0.68
	Total	486	3.33	1.340					
D12	Blacks	371	3.58	1.163					
	Coloureds	22	3.32	1.323			0.20		
	Indians	20	3.25	1.118	.000	.000	0.28	0.05	
	Whites	67	2.25	1.318			1.00	0.80	0.76
	Total	480	3.37	1.272					
D13	Blacks	359	3.95	1.019					
	Coloureds	22	3.77	.922			0.17		
	Indians	20	3.70	.923	.001	.017	0.24	0.08	
	Whites	68	3.40	1.329			0.41	0.28	0.23
	Total	469	3.85	1.076					
D14	Blacks	372	4.01	1.069					
	Coloureds	22	3.95	.899			0.05		
	Indians	20	4.30	.657	.392	.205	0.28	0.38	
	Whites	67	4.18	1.014			0.16	0.22	0.12
	Total	481	4.04	1.041					
D15	Blacks	372	3.45	1.149					
	Coloureds	22	3.59	1.008			0.12		
	Indians	20	3.40	.995	.715	.711	0.04	0.19	
	Whites	66	3.30	1.189			0.12	0.24	0.08
	Total	480	3.43	1.141					
D16	Blacks	371	3.60	1.145					
	Coloureds	22	3.68	1.086			0.07		
	Indians	20	3.55	1.050	.945	.940	0.05	0.12	
	Whites	65	3.68	1.077			0.06	0.00	0.12
	Total	478	3.62	1.126					
E1	Blacks	380	3.42	1.328					
	Coloureds	22	2.91	1.540			0.33		
	Indians	20	2.90	1.373	.099	.163	0.38	0.01	
	Whites	68	3.51	1.344			0.07	0.39	0.45
	Total	490	3.39	1.347					
E2	Blacks	376	2.60	1.233					
	Coloureds	22	2.41	1.260			0.15		
	Indians	19	2.47	.841	.480	.498	0.11	0.05	
	Whites	67	2.81	1.351			0.15	0.29	0.25
	Total	484	2.62	1.238					
E3	Blacks	376	2.65	1.252					
	Coloureds	22	2.32	1.323			0.25		
	Indians	19	2.42	.902	.511	.487	0.18	0.08	
	Whites	68	2.51	1.333			0.10	0.15	0.07
	Total	485	2.60	1.255					
F1	Blacks	371	3.89	1.203					
	Coloureds	23	3.91	1.311			0.02		
	Indians	20	4.20	.951	.062	.047	0.26	0.22	
	Whites	70	4.29	1.079			0.33	0.28	0.08
	Total	484	3.96	1.188					
F2	Blacks	371	2.89	1.314					
	Coloureds	23	2.74	1.389			0.11		
	Indians	20	3.05	.759	.133	.128	0.12	0.22	
	Whites	67	3.27	1.238			0.29	0.38	0.18
	Total	481	2.94	1.293					
F3	Blacks	365	3.30	1.174					
	Coloureds	23	2.70	1.428			0.42		
	Indians	20	2.65	.813	.009	.004	0.55	0.03	
	Whites	67	3.07	1.210			0.18	0.27	0.35
	Total	475	3.21	1.191					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.5b: Descriptive statistics and medium to large effect size for Race

A3: RACE		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B8	Blacks	381	3.94	1.159					
	Coloureds	22	4.09	1.192			0.13		
	Indians	21	4.48	.602	.094	.005	0.47	0.32	
	Whites	67	4.16	1.081			0.20	0.06	0.29
	Total	491	4.00	1.137					
B15	Blacks	364	3.06	1.398					
	Coloureds	15	3.40	1.298			0.24		
	Indians	17	3.71	1.404	.130	.154	0.46	0.22	
	Whites	58	2.86	1.382			0.14	0.39	0.60
	Total	454	3.07	1.397					
C3	Blacks	369	2.39	1.273					
	Coloureds	23	2.74	1.176			0.27		
	Indians	20	2.65	1.226	.160	.146	0.20	0.07	
	Whites	68	2.15	1.188			0.19	0.50	0.41
	Total	480	2.39	1.258					
C4	Blacks	374	2.93	1.188					
	Coloureds	23	3.04	1.224			0.09		
	Indians	19	3.37	1.065	.000	.000	0.37	0.27	
	Whites	70	3.83	1.227			0.73	0.64	0.37
	Total	486	3.08	1.229					
D1	Blacks	376	3.87	1.138					
	Coloureds	23	4.39	.941			0.46		
	Indians	20	4.05	1.146	.137	.077	0.16	0.30	
	Whites	68	3.79	1.100			0.07	0.54	0.22
	Total	487	3.89	1.128					
D4	Blacks	367	3.24	1.326					
	Coloureds	23	3.74	1.356			0.37		
	Indians	20	3.30	1.490	.002	.007	0.04	0.29	
	Whites	68	2.65	1.443			0.41	0.76	0.44
	Total	478	3.18	1.369					
D6	Blacks	367	3.21	1.248					
	Coloureds	23	3.91	1.276			0.55		
	Indians	20	3.80	1.152	.014	.019	0.48	0.09	
	Whites	68	3.19	1.352			0.01	0.53	0.45
	Total	478	3.26	1.271					
D7	Blacks	364	3.19	1.194					
	Coloureds	22	3.86	1.125			0.56		
	Indians	20	3.35	1.309	.085	.075	0.12	0.39	
	Whites	65	3.23	1.272			0.03	0.50	0.09
	Total	471	3.23	1.212					
D8	Blacks	280	2.20	1.364					
	Coloureds	17	3.59	1.583			0.87		
	Indians	17	2.76	1.678	.001	.007	0.33	0.49	
	Whites	53	2.45	1.526			0.16	0.72	0.19
	Total	367	2.33	1.442					
D11	Blacks	377	3.56	1.228					
	Coloureds	22	3.32	1.359			0.18		
	Indians	20	3.00	1.214	.000	.000	0.46	0.23	
	Whites	67	2.10	1.316			1.11	0.89	0.68
	Total	486	3.33	1.340					
D12	Blacks	371	3.58	1.163					
	Coloureds	22	3.32	1.323			0.20		
	Indians	20	3.25	1.118	.000	.000	0.28	0.05	
	Whites	67	2.25	1.318			1.00	0.80	0.76
	Total	480	3.37	1.272					
F3	Blacks	365	3.30	1.174					
	Coloureds	23	2.70	1.428			0.42		
	Indians	20	2.65	.813	.009	.004	0.55	0.03	
	Whites	67	3.07	1.210			0.18	0.27	0.35
	Total	475	3.21	1.191					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.3.4 Qualifications

Tables 3.6a & b show the results of the mean values calculated for the dimensions as a function of qualification as well as the effect size calculations. The effect size calculations indicate that medium or practically visible differences and large or practically significant differences are observed for B1, B2, B5, B8, B9, B11, B12, B15, C3, D3, D4, D8, D11, D12, D13, D16 and F2 (Table 3.6b).

Table 3.6a shows all the results obtained and Table 3.6b depicts results with medium or practically visible effects and results with large or practically significant effects. No practically/significantly visible differences were observed between the respondents with no qualifications and those with matric. The perceptions of the respondents with no qualifications are leaning to the negative side when compared with other groups. The overall responses of these respondents are mostly neutral to agree when other respondents agree (B1, B5, B6, B8, B11, B12, C1, D3, D13 and F1) or disagree to neutral when other respondents disagree (C3, D8). Medium or practically visible differences were observed between the responses of respondents with matric and those with postgraduate qualifications (B1, B8, B11, D3 and D11) as well as between the responses of respondents with certificates and postgraduate qualifications (D4, D11).

These results indicate that education of respondents influences their perceptions of wastewater reuse with those with matric qualification and less being less favourable about wastewater reuse than those with higher educational levels. This is in agreement with the study done by Robinson *et al*. (2005:63). According to Dolnicar and Saunders (2005:188) education of the individuals expressing their opinions has been the frequently found factor associated with acceptance of wastewater reuse.

Table 3.6a: Descriptive statistics and effect size results based qualifications

	A4: QUALIFICATIONS	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes 1 with	2 with ...	3 with	4 with .....
B1	No formal qualification	59	3.39	1.067						
	Matric	106	3.68	1.239			0.23			
	Certificate/diploma	105	3.93	1.059	0.000	0.000	0.51	0.21		
	Degree	137	4.09	1.039			0.65	0.33	0.15	
	Postgraduate	90	4.38	.815			0.93	0.56	0.42	0.28
	Total	497	3.94	1.095						
B2	No formal qualification	56	3.36	1.135						
	Matric	102	3.57	1.039			0.19			
	Certificate/diploma	106	3.79	.953	0.010	0.018	0.38	0.22		
	Degree	135	3.83	1.055			0.42	0.25	0.04	
	Postgraduate	86	3.90	1.029			0.47	0.31	0.10	0.06
	Total	485	3.72	1.045						
B3	No formal qualification	55	3.58	1.066						
	Matric	104	3.59	1.137			0.00			
	Certificate/diploma	106	3.33	1.136	0.038	0.044	0.22	0.23		
	Degree	136	3.15	1.305			0.33	0.33	0.13	
	Postgraduate	86	3.30	1.117			0.25	0.25	0.02	0.11
	Total	487	3.36	1.183						
B4	No formal qualification	58	3.26	1.069						
	Matric	103	3.46	1.064			0.18			
	Certificate/diploma	106	3.39	1.092	0.845	0.819	0.12	0.06		
	Degree	134	3.33	1.181			0.06	0.11	0.05	
	Postgraduate	87	3.33	1.273			0.06	0.10	0.04	0.00
	Total	488	3.36	1.140						
B5	No formal qualification	51	3.45	1.045						
	Matric	94	3.54	1.064			0.09			
	Certificate/diploma	96	3.78	.986	0.001	0.002	0.32	0.22		
	Degree	126	3.91	.963			0.44	0.35	0.13	
	Postgraduate	84	4.02	.878			0.55	0.45	0.25	0.12
	Total	451	3.78	1.000						
B6	No formal qualification	56	3.77	1.175						
	Matric	106	4.00	1.113			0.20			
	Certificate/diploma	109	4.31	.930	0.006	0.012	0.46	0.28		
	Degree	137	4.18	1.045			0.35	0.16	0.12	
	Postgraduate	87	4.29	.848			0.44	0.26	0.03	0.10
	Total	495	4.14	1.031						
B7	No formal qualification	55	4.29	.896						
	Matric	105	4.16	1.039			0.12			
	Certificate/diploma	106	4.31	.930	0.103	..039	0.02	0.14		
	Degree	134	4.29	.987			0.00	0.12	0.02	
	Postgraduate	86	4.53	.698			0.27	0.36	0.24	0.25
	Total	486	4.31	.935						
B8	No formal qualification	58	3.43	1.299						
	Matric	105	3.85	1.150			0.32			
	Certificate/diploma	110	4.03	1.062	0.000	0.000	0.46	0.16		
	Degree	136	4.10	1.173			0.51	0.21	0.06	
	Postgraduate	88	4.42	.813			0.76	0.50	0.37	0.28
	Total	497	4.01	1.134						
B9	No formal qualification	57	3.11	1.460						
	Matric	102	3.45	1.340			0.24			
	Certificate/diploma	108	3.73	1.301	0.002	0.003	0.43	0.21		
	Degree	137	3.59	1.337			0.33	0.10	0.10	
	Postgraduate	89	3.94	1.122			0.57	0.37	0.16	0.26
	Total	493	3.60	1.325						
B10	No formal qualification	57	3.47	1.283						
	Matric	104	3.53	1.365			0.04			
	Certificate/diploma	108	3.86	1.172	0.028	0.026	0.30	0.24		
	Degree	137	3.77	1.283			0.23	0.18	0.07	
	Postgraduate	88	4.01	1.067			0.42	0.35	0.13	0.19
	Total	494	3.75	1.250						
B11	No formal qualification	58	3.59	1.200						
	Matric	104	4.08	1.068			0.41			
	Certificate/diploma	108	4.19	1.043	0.000	0.000	0.50	0.10		
	Degree	133	4.28	.995			0.58	0.19	0.09	
	Postgraduate	86	4.59	.675			0.84	0.48	0.39	0.32
	Total	489	4.19	1.035						
B12	No formal qualification	56	3.82	1.363						
	Matric	103	4.15	1.141			0.24			
	Certificate/diploma	108	4.16	1.145	0.000	0.000	0.25	0.01		
	Degree	133	4.29	1.036			0.35	0.13	0.12	
	Postgraduate	85	4.66	.682			0.61	0.45	0.44	0.35
	Total	485	4.24	1.097						
B13	No formal qualification	55	2.25	1.566						
	Matric	104	2.26	1.507			0.00			
	Certificate/diploma	110	2.55	1.500	0.318	0.340	0.19	0.20		
	Degree	136	2.60	1.560			0.22	0.22	0.03	
	Postgraduate	86	2.37	1.381			0.08	0.07	0.12	0.15
	Total	491	2.44	1.507						
B14	No formal qualification	59	2.32	1.547						
	Matric	104	2.40	1.586			0.05			
	Certificate/diploma	109	2.54	1.506	0.453	0.423	0.14	0.09		
	Degree	137	2.61	1.540			0.19	0.13	0.05	
	Postgraduate	87	2.28	1.327			0.03	0.08	0.18	0.22
	Total	496	2.46	1.508						
B15	No formal qualification	53	2.58	1.351						
	Matric	93	3.16	1.432			0.40			
	Certificate/diploma	97	3.29	1.258	0.054	0.041	0.52	0.09		
	Degree	130	3.12	1.379			0.38	0.03	0.13	
	Postgraduate	85	3.02	1.551			0.28	0.09	0.17	0.06
	Total	458	3.08	1.404						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.6a continued

A4: QUALIFICATIONS		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							1 with	2 with ...	3 with	4 with .....
C1	No formal qualification	58	3.50	1.328	0.087	0.125				
	Matric	107	3.99	1.314			0.37			
	Certificate/diploma	109	3.94	1.227			0.33	0.04		
	Degree	134	3.96	1.204			0.35	0.02	0.02	
	Postgraduate	89	4.04	1.107			0.41	0.04	0.09	0.07
	Total	497	3.92	1.237						
C2	No formal qualification	56	3.05	1.135	0.367	0.384				
	Matric	104	3.21	1.212			0.13			
	Certificate/diploma	108	3.12	1.182			0.06	0.08		
	Degree	132	2.91	1.269			0.11	0.24	0.17	
	Postgraduate	88	2.97	1.291			0.07	0.19	0.12	0.04
	Total	488	3.05	1.228						
C3	No formal qualification	57	2.88	1.297	0.000	0.000				
	Matric	103	2.68	1.308			0.15			
	Certificate/diploma	106	2.57	1.273			0.24	0.09		
	Degree	131	1.95	1.098			0.72	0.56	0.49	
	Postgraduate	89	2.17	1.189			0.55	0.39	0.31	0.19
	Total	486	2.39	1.264						
C4	No formal qualification	59	2.90	1.170	0.074	0.080				
	Matric	107	3.21	1.287			0.24			
	Certificate/diploma	105	3.11	1.195			0.18	0.07		
	Degree	132	2.91	1.201			0.01	0.23	0.17	
	Postgraduate	89	3.33	1.268			0.34	0.09	0.17	0.33
	Total	492	3.09	1.233						
C5	No formal qualification	57	3.12	1.119	0.021	0.027				
	Matric	102	3.46	1.302			0.26			
	Certificate/diploma	102	3.18	1.246			0.04	0.22		
	Degree	130	2.97	1.251			0.12	0.38	0.17	
	Postgraduate	86	3.42	1.278			0.23	0.03	0.19	0.35
	Total	477	3.22	1.261						
D1	No formal qualification	58	3.50	1.288	0.043	0.088				
	Matric	105	3.88	1.222			0.29			
	Certificate/diploma	106	4.05	1.008			0.42	0.14		
	Degree	135	3.97	1.058			0.37	0.08	0.07	
	Postgraduate	89	3.91	1.051			0.32	0.03	0.13	0.06
	Total	493	3.90	1.119						
D2	No formal qualification	57	4.05	1.025	0.532	0.572				
	Matric	105	4.05	1.041			0.00			
	Certificate/diploma	107	4.13	1.047			0.07	0.08		
	Degree	134	3.98	1.029			0.07	0.07	0.15	
	Postgraduate	88	3.88	1.153			0.15	0.15	0.22	0.09
	Total	491	4.02	1.057						
D3	No formal qualification	56	3.63	1.287	0.000	0.000				
	Matric	101	3.68	1.303			0.04			
	Certificate/diploma	108	4.19	1.072			0.44	0.39		
	Degree	135	4.12	1.093			0.38	0.33	0.07	
	Postgraduate	86	4.41	.726			0.61	0.56	0.20	0.26
	Total	486	4.04	1.136						
D4	No formal qualification	57	3.37	1.234	0.002	0.002				
	Matric	102	3.35	1.426			0.01			
	Certificate/diploma	105	3.44	1.293			0.05	0.06		
	Degree	131	3.12	1.359			0.18	0.16	0.23	
	Postgraduate	87	2.70	1.382			0.48	0.46	0.53	0.30
	Total	482	3.19	1.369						
D5	No formal qualification	53	3.30	1.137	0.461	0.446				
	Matric	101	3.38	1.287			0.06			
	Certificate/diploma	105	3.60	1.260			0.24	0.17		
	Degree	133	3.31	1.280			0.00	0.05	0.23	
	Postgraduate	89	3.42	1.355			0.08	0.03	0.14	0.08
	Total	481	3.41	1.276						
D6	No formal qualification	57	3.12	1.226	0.608	0.609				
	Matric	103	3.33	1.263			0.16			
	Certificate/diploma	103	3.41	1.287			0.22	0.06		
	Degree	134	3.19	1.289			0.06	0.11	0.17	
	Postgraduate	87	3.30	1.259			0.14	0.02	0.08	0.08
	Total	484	3.28	1.269						
D7	No formal qualification	52	2.94	1.305	0.082	0.089				
	Matric	103	3.20	1.316			0.20			
	Certificate/diploma	103	3.44	1.109			0.38	0.18		
	Degree	133	3.32	1.118			0.29	0.09	0.10	
	Postgraduate	85	3.07	1.242			0.10	0.10	0.29	0.20
	Total	476	3.24	1.210						
D8	No formal qualification	49	2.88	1.317	0.008	0.003				
	Matric	80	2.39	1.419			0.35			
	Certificate/diploma	81	2.47	1.629			0.25	0.05		
	Degree	101	2.23	1.413			0.46	0.11	0.15	
	Postgraduate	61	1.90	1.274			0.74	0.34	0.35	0.23
	Total	372	2.35	1.450						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.6a continued

A4: QUALIFICATIONS		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							1 with	2 with ...	3 with	4 with .....
D11	No formal qualification	59	3.54	1.317	0.000	0.000				
	Matric	104	3.51	1.414			0.02			
	Certificate/diploma	109	3.64	1.175			0.08	0.09		
	Degree	133	3.21	1.297			0.25	0.21	0.33	
	Postgraduate	87	2.79	1.415			0.53	0.51	0.60	0.29
	Total	492	3.34	1.349						
D12	No formal qualification	56	3.39	1.201	0.004	0.007				
	Matric	103	3.55	1.312			0.12			
	Certificate/diploma	107	3.60	1.204			0.17	0.03		
	Degree	133	3.34	1.230			0.04	0.16	0.21	
	Postgraduate	87	2.94	1.350			0.33	0.45	0.49	0.29
	Total	486	3.38	1.276						
D13	No formal qualification	52	3.31	1.197	0.000	0.001				
	Matric	101	3.83	1.049			0.44			
	Certificate/diploma	105	4.11	.974			0.67	0.27		
	Degree	131	3.95	.979			0.53	0.11	0.17	
	Postgraduate	86	3.76	1.127			0.37	0.07	0.32	0.17
	Total	475	3.85	1.066						
D14	No formal qualification	58	3.67	1.205	0.004	0.012				
	Matric	102	3.88	1.163			0.17			
	Certificate/diploma	106	4.21	.983			0.44	0.28		
	Degree	131	4.08	.953			0.34	0.17	0.13	
	Postgraduate	90	4.21	.880			0.45	0.28	0.00	0.13
	Total	487	4.04	1.038						
D15	No formal qualification	58	3.17	1.258	0.009	0.012				
	Matric	101	3.61	1.149			0.35			
	Certificate/diploma	108	3.67	1.094			0.39	0.05		
	Degree	133	3.43	1.103			0.20	0.16	0.22	
	Postgraduate	86	3.20	1.136			0.02	0.36	0.41	0.20
	Total	486	3.45	1.147						
D16	No formal qualification	59	3.25	1.334	0.007	0.016				
	Matric	101	3.48	1.213			0.17			
	Certificate/diploma	106	3.88	1.021			0.47	0.33		
	Degree	130	3.67	1.074			0.31	0.16	0.19	
	Postgraduate	87	3.68	1.006			0.32	0.17	0.20	0.01
	Total	483	3.63	1.128						
E1	No formal qualification	58	3.38	1.437	0.090	0.005				
	Matric	104	3.19	1.469			0.13			
	Certificate/diploma	109	3.40	1.306			0.02	0.14		
	Degree	136	3.24	1.308			0.10	0.03	0.12	
	Postgraduate	89	3.83	1.199			0.31	0.44	0.33	0.45
	Total	496	3.39	1.353						
E2	No formal qualification	57	2.39	1.098	0.190	0.174				
	Matric	103	2.49	1.228			0.08			
	Certificate/diploma	106	2.69	1.198			0.25	0.17		
	Degree	135	2.63	1.297			0.19	0.11	0.05	
	Postgraduate	89	2.83	1.308			0.34	0.26	0.11	0.15
	Total	490	2.62	1.245						
E3	No formal qualification	58	2.38	1.152	0.167	0.150				
	Matric	104	2.53	1.284			0.12			
	Certificate/diploma	105	2.67	1.253			0.23	0.11		
	Degree	135	2.56	1.273			0.14	0.03	0.08	
	Postgraduate	89	2.87	1.245			0.39	0.26	0.16	0.24
	Total	491	2.61	1.256						
F1	No formal qualification	54	3.81	1.214	0.006	0.003				
	Matric	106	3.69	1.355			0.09			
	Certificate/diploma	108	3.99	1.279			0.14	0.22		
	Degree	133	4.02	1.073			0.16	0.24	0.02	
	Postgraduate	89	4.30	.884			0.40	0.45	0.24	0.27
	Total	490	3.97	1.185						
F2	No formal qualification	55	2.55	1.230	0.003	0.003				
	Matric	103	2.71	1.384			0.12			
	Certificate/diploma	107	2.93	1.305			0.30	0.16		
	Degree	134	3.07	1.215			0.42	0.26	0.10	
	Postgraduate	88	3.27	1.220			0.59	0.41	0.26	0.17
	Total	487	2.94	1.290						
F3	No formal qualification	56	3.29	1.202	0.249	0.279				
	Matric	103	3.03	1.317			0.19			
	Certificate/diploma	104	3.35	1.205			0.05	0.24		
	Degree	130	3.13	1.144			0.13	0.08	0.18	
	Postgraduate	88	3.33	1.080			0.04	0.23	0.01	0.17
	Total	481	3.21	1.194						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.6b: Descriptive statistics and medium to large effect size for qualifications

	A4: QUALIFICATIONS	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							1 with	2 with ...	3 with	4 with .....
B1	No formal qualification	59	3.39	1.067	0.000	0.000				
	Matric	106	3.68	1.239			0.23			
	Certificate/diploma	105	3.93	1.059			0.51	0.21		
	Degree	137	4.09	1.039			0.65	0.33	0.15	
	Postgraduate	90	4.38	.815			0.93	0.56	0.42	0.28
	Total	497	3.94	1.095						
B2	No formal qualification	56	3.36	1.135	0.010	0.018				
	Matric	102	3.57	1.039			0.19			
	Certificate/diploma	106	3.79	.953			0.38	0.22		
	Degree	135	3.83	1.055			0.42	0.25	0.04	
	Postgraduate	86	3.90	1.029			0.47	0.31	0.10	0.06
	Total	485	3.72	1.045						
B5	No formal qualification	51	3.45	1.045	0.001	0.002				
	Matric	94	3.54	1.064			0.09			
	Certificate/diploma	96	3.78	.986			0.32	0.22		
	Degree	126	3.91	.963			0.44	0.35	0.13	
	Postgraduate	84	4.02	.878			0.55	0.45	0.25	0.12
	Total	451	3.78	1.000						
B8	No formal qualification	58	3.43	1.299	0.000	0.000				
	Matric	105	3.85	1.150			0.32			
	Certificate/diploma	110	4.03	1.062			0.46	0.16		
	Degree	136	4.10	1.173			0.51	0.21	0.06	
	Postgraduate	88	4.42	.813			0.76	0.50	0.37	0.28
	Total	497	4.01	1.134						
B9	No formal qualification	57	3.11	1.460	0.002	0.003				
	Matric	102	3.45	1.340			0.24			
	Certificate/diploma	108	3.73	1.301			0.43	0.21		
	Degree	137	3.59	1.337			0.33	0.10	0.10	
	Postgraduate	89	3.94	1.122			0.57	0.37	0.16	0.26
	Total	493	3.60	1.325						
B11	No formal qualification	58	3.59	1.200	0.000	0.000				
	Matric	104	4.08	1.068			0.41			
	Certificate/diploma	108	4.19	1.043			0.50	0.10		
	Degree	133	4.28	.995			0.58	0.19	0.09	
	Postgraduate	86	4.59	.675			0.84	0.48	0.39	0.32
	Total	489	4.19	1.035						
B12	No formal qualification	56	3.82	1.363	0.000	0.000				
	Matric	103	4.15	1.141			0.24			
	Certificate/diploma	108	4.16	1.145			0.25	0.01		
	Degree	133	4.29	1.036			0.35	0.13	0.12	
	Postgraduate	85	4.66	.682			0.61	0.45	0.44	0.35
	Total	485	4.24	1.097						
B15	No formal qualification	53	2.58	1.351	0.054	0.041				
	Matric	93	3.16	1.432			0.40			
	Certificate/diploma	97	3.29	1.258			0.52	0.09		
	Degree	130	3.12	1.379			0.38	0.03	0.13	
	Postgraduate	85	3.02	1.551			0.28	0.09	0.17	0.06
	Total	458	3.08	1.404						
C3	No formal qualification	57	2.88	1.297	0.000	0.000				
	Matric	103	2.68	1.308			0.15			
	Certificate/diploma	106	2.57	1.273			0.24	0.09		
	Degree	131	1.95	1.098			0.72	0.56	0.49	
	Postgraduate	89	2.17	1.189			0.55	0.39	0.31	0.19
	Total	486	2.39	1.264						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.6b continued

A4: QUALIFICATIONS		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes			
							1 with	2 with ...	3 with	4 with .....
D3	No formal qualification	56	3.63	1.287	0.000	0.000				
	Matric	101	3.68	1.303			0.04			
	Certificate/diploma	108	4.19	1.072			0.44	0.39		
	Degree	135	4.12	1.093			0.38	0.33	0.07	
	Postgraduate	86	4.41	.726			0.61	0.56	0.20	0.26
	Total	486	4.04	1.136						
D4	No formal qualification	57	3.37	1.234	0.002	0.002				
	Matric	102	3.35	1.426			0.01			
	Certificate/diploma	105	3.44	1.293			0.05	0.06		
	Degree	131	3.12	1.359			0.18	0.16	0.23	
	Postgraduate	87	2.70	1.382			0.48	0.46	0.53	0.30
	Total	482	3.19	1.369						
D8	No formal qualification	49	2.88	1.317	0.008	0.003				
	Matric	80	2.39	1.419			0.35			
	Certificate/diploma	81	2.47	1.629			0.25	0.05		
	Degree	101	2.23	1.413			0.46	0.11	0.15	
	Postgraduate	61	1.90	1.274			0.74	0.34	0.35	0.23
	Total	372	2.35	1.450						
D11	No formal qualification	59	3.54	1.317	0.000	0.000				
	Matric	104	3.51	1.414			0.02			
	Certificate/diploma	109	3.64	1.175			0.08	0.09		
	Degree	133	3.21	1.297			0.25	0.21	0.33	
	Postgraduate	87	2.79	1.415			0.53	0.51	0.60	0.29
	Total	492	3.34	1.349						
D12	No formal qualification	56	3.39	1.201	0.004	0.007				
	Matric	103	3.55	1.312			0.12			
	Certificate/diploma	107	3.60	1.204			0.17	0.03		
	Degree	133	3.34	1.230			0.04	0.16	0.21	
	Postgraduate	87	2.94	1.350			0.33	0.45	0.49	0.29
	Total	486	3.38	1.276						
D13	No formal qualification	52	3.31	1.197	0.000	0.001				
	Matric	101	3.83	1.049			0.44			
	Certificate/diploma	105	4.11	.974			0.67	0.27		
	Degree	131	3.95	.979			0.53	0.11	0.17	
	Postgraduate	86	3.76	1.127			0.37	0.07	0.32	0.17
	Total	475	3.85	1.066						
D16	No formal qualification	59	3.25	1.334	0.007	0.016				
	Matric	101	3.48	1.213			0.17			
	Certificate/diploma	106	3.88	1.021			0.47	0.33		
	Degree	130	3.67	1.074			0.31	0.16	0.19	
	Postgraduate	87	3.68	1.006			0.32	0.17	0.20	0.01
	Total	483	3.63	1.128						
F2	No formal qualification	55	2.55	1.230	0.003	0.003				
	Matric	103	2.71	1.384			0.12			
	Certificate/diploma	107	2.93	1.305			0.30	0.16		
	Degree	134	3.07	1.215			0.42	0.26	0.10	
	Postgraduate	88	3.27	1.220			0.59	0.41	0.26	0.17
	Total	487	2.94	1.290						

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.3.5 Level of employment

Tables 3.7a & b show the results of perceptions of respondents based on their levels of employment.

The effect size calculations indicate that medium size or practically visible differences are observed in questions B2 (reusing wastewater reduces the amounts of pollutants discharged in the environment), C3 (concerned about wastewater reuse due to religious beliefs), D4 (use of municipal/other government agencies to access information about environmental issues) and D11 (trust local municipalities' opinion about wastewater reuse) between the responses of people who are not employed and those who hold senior positions (B2), middle positions (C3, D11) and non-management positions (D4, D11). These findings are in agreement with reported literature where income of consumers affected perceptions on wastewater reuse (Alhumoud & Madzikanda 2010:150; Dishman *et al*., 2009:157).

Table 3.7a: Descriptive statistics and effect size results based on employment level

	A5: LEVEL OF EMPLOYMENT	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes				
							Not Employed	Junior with ..	Middle with .	Senior with .	Non-Man
B1	Not Employed	113	3.81	1.059							
	Junior	110	3.88	1.163			0.07				
	Middle	140	4.06	1.061			0.24	0.16			
	Senior	66	4.08	1.042	0.433	0.419	0.26	0.17	0.01		
	Non-Management	24	3.96	1.042			0.14	0.07	0.10	0.11	
	Other	28	3.89	1.286			0.07	0.01	0.13	0.14	0.05
	Total	481	3.95	1.095							
B2	Not Employed	107	3.53	1.049							
	Junior	109	3.72	1.044			0.18				
	Middle	138	3.78	1.079			0.23	0.05			
	Senior	63	4.03	.861	0.067	0.037	0.48	0.29	0.23		
	Non-Management	25	3.52	1.194			0.01	0.17	0.22	0.43	
	Other	28	3.68	1.188			0.12	0.04	0.09	0.30	0.13
	Total	470	3.73	1.057							
B3	Not Employed	106	3.53	1.156							
	Junior	108	3.41	1.208			0.10				
	Middle	141	3.23	1.179			0.26	0.15			
	Senior	63	3.27	1.208	0.444	0.442	0.21	0.11	0.04		
	Non-Management	25	3.24	1.128			0.25	0.14	0.01	0.02	
	Other	27	3.26	1.318			0.20	0.11	0.02	0.01	0.01
	Total	470	3.34	1.190							
B4	Not Employed	109	3.41	1.090							
	Junior	107	3.21	1.149			0.17				
	Middle	138	3.38	1.210			0.02	0.14			
	Senior	65	3.42	1.029	0.703	0.721	0.00	0.17	0.03		
	Non-Management	25	3.16	1.248			0.20	0.04	0.18	0.20	
	Other	28	3.43	1.136			0.01	0.19	0.04	0.01	0.22
	Total	472	3.35	1.141							
B5	Not Employed	92	3.67	1.018							
	Junior	103	3.70	1.101			0.02				
	Middle	131	3.92	.929			0.24	0.20			
	Senior	59	3.69	1.021	0.462	0.443	0.02	0.00	0.22		
	Non-Management	23	3.78	.902			0.11	0.08	0.14	0.09	
	Other	28	3.86	1.008			0.18	0.14	0.06	0.16	0.07
	Total	436	3.77	1.006							
B6	Not Employed	110	3.95	1.104							
	Junior	109	4.09	1.023			0.12				
	Middle	141	4.24	1.041			0.26	0.14			
	Senior	65	4.28	.839	0.233	0.259	0.29	0.18	0.03		
	Non-Management	25	4.12	.927			0.15	0.03	0.12	0.17	
	Other	29	4.28	1.131			0.28	0.16	0.03	0.00	0.14
	Total	479	4.14	1.029							
B7	Not Employed	107	4.33	.888							
	Junior	107	4.20	.985			0.13				
	Middle	140	4.32	.998			0.01	0.13			
	Senior	64	4.38	.917	0.520	0.467	0.05	0.18	0.05		
	Non-Management	24	4.13	.797			0.23	0.07	0.20	0.27	
	Other	29	4.52	.871			0.21	0.33	0.20	0.16	0.45
	Total	471	4.30	.943							
B8	Not Employed	111	3.73	1.265							
	Junior	109	4.05	1.040			0.25				
	Middle	141	4.12	1.118			0.31	0.07			
	Senior	66	4.14	1.135	0.018	0.022	0.32	0.08	0.01		
	Non-Management	25	3.80	1.080			0.06	0.23	0.29	0.30	
	Other	29	4.41	.907			0.54	0.35	0.26	0.24	0.57
	Total	481	4.02	1.136							
B9	Not Employed	108	3.44	1.403							
	Junior	107	3.59	1.288			0.10				
	Middle	143	3.55	1.298			0.08	0.03			
	Senior	66	3.92	1.219	0.168	0.167	0.34	0.26	0.29		
	Non-Management	25	3.44	1.325			0.00	0.11	0.08	0.37	
	Other	28	3.93	1.359			0.35	0.25	0.28	0.00	0.36
	Total	477	3.60	1.319							
B10	Not Employed	109	3.79	1.299							
	Junior	110	3.57	1.260			0.17				
	Middle	141	3.87	1.286			0.06	0.23			
	Senior	65	3.78	1.231	0.585	0.601	0.00	0.17	0.07		
	Non-Management	24	3.71	.955			0.06	0.11	0.13	0.06	
	Other	29	3.83	1.256			0.03	0.20	0.03	0.03	0.09
	Total	478	3.76	1.258							

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.7a continued

	A5: LEVEL OF EMPLOYMENT	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes				
							Not Employed	Junior with ..	Middle with .	Senior with .	Non-Man
B11	Not Employed	108	3.84	1.201							
	Junior	110	4.20	1.030			0.30				
	Middle	141	4.35	.942			0.43	0.15			
	Senior	63	4.32	.820	0.003	0.015	0.40	0.11	0.04		
	Non-Management	24	4.33	.917			0.41	0.13	0.02	0.02	
	Other	29	4.31	1.004			0.39	0.11	0.04	0.01	0.02
	Total	475	4.19	1.029							
B12	Not Employed	106	4.15	1.209							
	Junior	108	4.11	1.225			0.03				
	Middle	140	4.32	1.034			0.14	0.17			
	Senior	63	4.32	.930	0.451	0.441	0.14	0.17	0.00		
	Non-Management	24	4.42	.830			0.22	0.25	0.09	0.11	
	Other	28	4.43	.920			0.23	0.26	0.10	0.12	0.01
	Total	469	4.25	1.095							
B13	Not Employed	107	2.45	1.627							
	Junior	111	2.34	1.474			0.07				
	Middle	141	2.57	1.451			0.07	0.15			
	Senior	62	2.44	1.543	0.670	0.658	0.01	0.06	0.09		
	Non-Management	25	2.76	1.508			0.19	0.28	0.13	0.21	
	Other	29	2.21	1.473			0.15	0.09	0.24	0.15	0.37
	Total	475	2.46	1.511							
B14	Not Employed	112	2.50	1.605							
	Junior	110	2.33	1.491			0.11				
	Middle	140	2.53	1.476			0.02	0.14			
	Senior	65	2.52	1.501	0.692	0.677	0.01	0.13	0.00		
	Non-Management	24	2.79	1.414			0.18	0.31	0.18	0.18	
	Other	29	2.24	1.550			0.16	0.06	0.19	0.18	0.35
	Total	480	2.47	1.512							
B15	Not Employed	94	3.07	1.454							
	Junior	101	2.86	1.371			0.15				
	Middle	135	3.14	1.378			0.05	0.20			
	Senior	62	3.15	1.435	0.382	0.300	0.05	0.20	0.00		
	Non-Management	23	3.48	1.123			0.28	0.45	0.24	0.23	
	Other	28	3.29	1.536			0.14	0.28	0.09	0.09	0.13
	Total	443	3.09	1.400							
C1	Not Employed	114	3.91	1.259							
	Junior	110	4.01	1.281			0.08				
	Middle	141	3.86	1.228			0.04	0.12			
	Senior	64	4.06	1.037	0.407	0.357	0.12	0.04	0.17		
	Non-Management	25	3.60	1.291			0.24	0.32	0.20	0.36	
	Other	28	4.21	.995			0.24	0.16	0.29	0.15	0.48
	Total	482	3.94	1.216							
C2	Not Employed	110	3.15	1.210							
	Junior	109	3.00	1.217			0.12				
	Middle	138	2.98	1.247			0.13	0.02			
	Senior	63	3.08	1.168	0.740	0.777	0.05	0.07	0.08		
	Non-Management	25	3.00	1.291			0.11	0.00	0.02	0.06	
	Other	28	3.32	1.335			0.13	0.24	0.26	0.18	0.24
	Total	473	3.06	1.226							
C3	Not Employed	111	2.80	1.299							
	Junior	108	2.25	1.261			0.42				
	Middle	138	2.15	1.177			0.50	0.08			
	Senior	62	2.34	1.254	0.002	0.005	0.36	0.07	0.15		
	Non-Management	24	2.42	1.176			0.30	0.13	0.22	0.06	
	Other	28	2.39	1.257			0.31	0.11	0.19	0.04	0.02
	Total	471	2.38	1.259							
C4	Not Employed	109	3.11	1.181							
	Junior	110	2.95	1.160			0.13				
	Middle	141	3.09	1.309			0.01	0.11			
	Senior	64	3.20	1.262	0.652	0.661	0.07	0.20	0.08		
	Non-Management	25	3.36	1.350			0.19	0.30	0.20	0.12	
	Other	28	3.21	1.228			0.08	0.21	0.09	0.01	0.11
	Total	477	3.10	1.236							
C5	Not Employed	107	3.33	1.188							
	Junior	107	3.08	1.333			0.18				
	Middle	137	3.20	1.261			0.10	0.09			
	Senior	60	3.13	1.295	0.746	0.759	0.15	0.04	0.05		
	Non-Management	25	3.28	1.208			0.04	0.15	0.06	0.11	
	Other	27	3.37	1.334			0.03	0.21	0.12	0.18	0.07
	Total	463	3.21	1.264							

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.7a continued

	A5: LEVEL OF EMPLOYMENT	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes				
							Not Employed	Junior with ..	Middle with .	Senior with .	Non-Man
D1	Not Employed	112	3.86	1.229							
	Junior	110	3.75	1.161			0.09				
	Middle	139	4.03	1.021			0.14	0.24			
	Senior	66	3.85	1.099	0.281	0.221	0.01	0.09	0.16		
	Non-Management	23	3.78	1.085			0.06	0.03	0.23	0.06	
	Other	28	4.18	.905			0.26	0.37	0.15	0.30	0.36
	Total	478	3.90	1.115							
D2	Not Employed	111	4.14	1.017							
	Junior	110	3.91	1.162			0.20				
	Middle	139	3.99	1.042			0.15	0.07			
	Senior	66	4.00	.961	0.049	0.002	0.14	0.08	0.01		
	Non-Management	23	3.65	1.112			0.44	0.22	0.30	0.31	
	Other	27	4.48	.580			0.33	0.49	0.48	0.50	0.75
	Total	476	4.02	1.045							
D3	Not Employed	109	3.91	1.229							
	Junior	107	3.93	1.257			0.01				
	Middle	141	4.23	.961			0.27	0.25			
	Senior	65	4.02	1.082	0.009	0.000	0.09	0.07	0.20		
	Non-Management	23	3.74	1.137			0.14	0.15	0.44	0.24	
	Other	26	4.62	.571			0.58	0.55	0.40	0.55	0.77
	Total	471	4.06	1.121							
D4	Not Employed	111	3.47	1.299							
	Junior	106	3.24	1.321			0.18				
	Middle	136	2.95	1.426			0.36	0.20			
	Senior	65	3.02	1.352	0.039	0.045	0.34	0.16	0.05		
	Non-Management	22	2.82	1.368			0.48	0.31	0.09	0.14	
	Other	27	3.33	1.468			0.09	0.07	0.26	0.22	0.35
	Total	467	3.16	1.372							
D5	Not Employed	106	3.47	1.236							
	Junior	108	3.23	1.344			0.18				
	Middle	138	3.46	1.302			0.01	0.17			
	Senior	64	3.44	1.180	0.478	0.534	0.03	0.15	0.01		
	Non-Management	22	3.18	1.435			0.20	0.03	0.19	0.18	
	Other	28	3.68	1.249			0.17	0.33	0.17	0.19	0.35
	Total	466	3.41	1.284							
D6	Not Employed	109	3.44	1.301							
	Junior	107	3.09	1.233			0.27				
	Middle	138	3.24	1.338			0.15	0.11			
	Senior	65	3.34	1.203	0.501	0.506	0.08	0.20	0.07		
	Non-Management	22	3.32	1.086			0.09	0.18	0.06	0.02	
	Other	28	3.32	1.278			0.09	0.18	0.06	0.01	0.00
	Total	469	3.28	1.272							
D7	Not Employed	109	3.27	1.310							
	Junior	106	3.08	1.209			0.15				
	Middle	129	3.31	1.198			0.03	0.19			
	Senior	66	3.18	1.122	0.661	0.657	0.06	0.09	0.11		
	Non-Management	25	3.44	1.158			0.13	0.30	0.11	0.22	
	Other	26	3.19	1.167			0.06	0.10	0.10	0.01	0.21
	Total	461	3.23	1.211							
D8	Not Employed	84	2.68	1.498							
	Junior	82	2.20	1.356			0.32				
	Middle	101	2.32	1.435			0.24	0.08			
	Senior	54	2.22	1.396	0.113	0.139	0.30	0.02	0.07		
	Non-Management	20	2.60	1.603			0.05	0.25	0.18	0.24	
	Other	21	1.86	1.352			0.55	0.25	0.32	0.26	0.46
	Total	362	2.35	1.440							
D11	Not Employed	114	3.77	1.137							
	Junior	107	3.52	1.298			0.19				
	Middle	140	2.96	1.380			0.59	0.41			
	Senior	64	3.22	1.408	0.000	0.000	0.39	0.22	0.18		
	Non-Management	24	3.13	1.329			0.49	0.30	0.12	0.07	
	Other	28	3.29	1.607			0.30	0.15	0.20	0.04	0.10
	Total	477	3.34	1.353							
D12	Not Employed	111	3.68	1.128							
	Junior	106	3.46	1.197			0.19				
	Middle	140	3.16	1.290			0.40	0.23			
	Senior	63	3.16	1.394	0.023	0.022	0.38	0.22	0.00		
	Non-Management	23	3.35	1.369			0.25	0.08	0.13	0.14	
	Other	28	3.54	1.575			0.09	0.05	0.24	0.24	0.12
	Total	471	3.38	1.281							

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.7a continued

	A5: LEVEL OF EMPLOYMENT	N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes				
							Not Employed	Junior with ..	Middle with .	Senior with .	Non-Man
D13	Not Employed	103	3.70	1.128							
	Junior	104	3.96	1.042			0.23				
	Middle	140	3.91	1.035			0.19	0.05			
	Senior	63	3.73	1.139	0.254	0.280	0.03	0.20	0.16		
	Non-Management	23	3.78	1.043			0.07	0.17	0.13	0.05	
	Other	27	4.15	1.027			0.40	0.18	0.23	0.37	0.35
	Total	460	3.86	1.074							
D14	Not Employed	112	3.89	1.077							
	Junior	107	4.02	1.124			0.11				
	Middle	137	4.21	.903			0.30	0.17			
	Senior	65	4.12	.976	0.254	0.235	0.21	0.09	0.09		
	Non-Management	23	3.96	1.065			0.06	0.06	0.24	0.16	
	Other	28	4.04	1.105			0.13	0.02	0.16	0.08	0.07
	Total	472	4.06	1.030							
D15	Not Employed	111	3.54	1.227							
	Junior	107	3.39	1.114			0.12				
	Middle	139	3.47	1.105			0.06	0.07			
	Senior	63	3.33	1.191	0.850	0.879	0.17	0.05	0.11		
	Non-Management	23	3.30	1.396			0.17	0.06	0.12	0.02	
	Other	28	3.39	.994			0.12	0.00	0.07	0.05	0.06
	Total	471	3.44	1.154							
D16	Not Employed	112	3.61	1.283							
	Junior	106	3.63	1.141			0.02				
	Middle	137	3.62	1.112			0.01	0.01			
	Senior	63	3.63	.989	0.950	0.930	0.02	0.00	0.01		
	Non-Management	23	3.57	1.121			0.03	0.06	0.05	0.06	
	Other	27	3.85	1.027			0.19	0.19	0.21	0.21	0.26
	Total	468	3.63	1.138							
E1	Not Employed	112	3.43	1.393							
	Junior	109	3.33	1.327			0.07				
	Middle	140	3.40	1.307			0.02	0.05			
	Senior	66	3.26	1.373	0.906	0.909	0.12	0.05	0.10		
	Non-Management	25	3.36	1.381			0.05	0.02	0.03	0.07	
	Other	29	3.59	1.323			0.11	0.19	0.14	0.24	0.16
	Total	481	3.38	1.341							
E2	Not Employed	108	2.47	1.172							
	Junior	109	2.51	1.183			0.04				
	Middle	140	2.70	1.262			0.18	0.15			
	Senior	65	2.63	1.318	0.442	0.445	0.12	0.09	0.05		
	Non-Management	25	2.96	1.241			0.39	0.36	0.21	0.25	
	Other	28	2.64	1.311			0.13	0.10	0.04	0.01	0.24
	Total	475	2.61	1.234							
E3	Not Employed	107	2.46	1.184							
	Junior	108	2.50	1.180			0.04				
	Middle	141	2.67	1.307			0.16	0.13			
	Senior	67	2.84	1.344	0.407	0.435	0.28	0.25	0.13		
	Non-Management	25	2.72	1.275			0.21	0.17	0.04	0.09	
	Other	28	2.64	1.254			0.15	0.11	0.02	0.14	0.06
	Total	476	2.61	1.253							
F1	Not Employed	106	3.95	1.253							
	Junior	108	3.86	1.180			0.07				
	Middle	142	4.04	1.129			0.07	0.15			
	Senior	65	4.00	1.250	0.830	0.805	0.04	0.11	0.03		
	Non-Management	25	3.92	1.152			0.03	0.05	0.11	0.06	
	Other	29	4.14	1.026			0.15	0.23	0.08	0.11	0.19
	Total	475	3.97	1.178							
F2	Not Employed	107	2.74	1.348							
	Junior	108	2.72	1.303			0.01				
	Middle	141	3.13	1.230			0.29	0.31			
	Senior	65	2.83	1.282	0.012	0.014	0.07	0.08	0.23		
	Non-Management	24	3.25	1.073			0.38	0.41	0.10	0.33	
	Other	27	3.44	1.281			0.52	0.55	0.25	0.48	0.15
	Total	472	2.93	1.291							
F3	Not Employed	106	3.16	1.273							
	Junior	104	3.29	1.188			0.10				
	Middle	140	3.24	1.099			0.06	0.04			
	Senior	64	2.91	1.306	0.408	0.502	0.19	0.29	0.26		
	Non-Management	24	3.25	.944			0.07	0.03	0.01	0.26	
	Other	28	3.32	1.249			0.13	0.03	0.06	0.32	0.06
	Total	466	3.19	1.192							

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.7b: Descriptive statistics and medium effect size for employment levels

A5: LEVEL OF EMPLOYMENT		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes				
							Not Employed	Junior with ..	Middle with .	Senior with .	Non-Man
B2	Not Employed	107	3.53	1.049							
	Junior	109	3.72	1.044			0.18				
	Middle	138	3.78	1.079			0.23	0.05			
	Senior	63	4.03	.861	0.067	0.037	0.48	0.29	0.23		
	Non-Management	25	3.52	1.194			0.01	0.17	0.22	0.43	
	Other	28	3.68	1.188			0.12	0.04	0.09	0.30	0.13
	Total	470	3.73	1.057							
C3	Not Employed	111	2.80	1.299							
	Junior	108	2.25	1.261			0.42				
	Middle	138	2.15	1.177			0.50	0.08			
	Senior	62	2.34	1.254	0.002	0.005	0.36	0.07	0.15		
	Non-Management	24	2.42	1.176			0.30	0.13	0.22	0.06	
	Other	28	2.39	1.257			0.31	0.11	0.19	0.04	0.02
	Total	471	2.38	1.259							
D4	Not Employed	111	3.47	1.299							
	Junior	106	3.24	1.321			0.18				
	Middle	136	2.95	1.426			0.36	0.20			
	Senior	65	3.02	1.352	0.039	0.045	0.34	0.16	0.05		
	Non-Management	22	2.82	1.368			0.48	0.31	0.09	0.14	
	Other	27	3.33	1.468			0.09	0.07	0.26	0.22	0.35
	Total	467	3.16	1.372							
D11	Not Employed	114	3.77	1.137							
	Junior	107	3.52	1.298			0.19				
	Middle	140	2.96	1.380			0.59	0.41			
	Senior	64	3.22	1.408	0.000	0.000	0.39	0.22	0.18		
	Non-Management	24	3.13	1.329			0.49	0.30	0.12	0.07	
	Other	28	3.29	1.607			0.30	0.15	0.20	0.04	0.10
	Total	477	3.34	1.353							

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.3.5 Knowledge of wastewater reuse

Tables 3.8a & b show the results of the mean values calculated for the dimensions based on knowledge of wastewater reuse as well as the effect size results. The effect size calculations indicate that medium or practically visible differences are observed for questions B2, B5, D1, D3, D5, D8 and F2 (Table 3.8b). Respondents with little or no knowledge of wastewater reuse were more negative and sometimes had no opinions as compared to people with sufficient/high knowledge whose opinions were more favourable about wastewater reuse except for instances where there is direct contact with treated wastewater. Some studies have reported similar results (Dolnicar *et al*., 2011:933; Hurlimann *et al*., 2008:1221).

Knowledge of wastewater reuse has been reported to be one of the factors affecting perceptions of consumers on wastewater reuse (Alhumoud & Madzikanda, 2010:147).

Table 3.8a: Descriptive statistics and effect size results based on knowledge of wastewater reuse

Knowledge of wastewater reuse		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B1	None	62	3.71	1.246					
	Little	198	3.76	1.105			0.04		
	Sufficient	183	4.14	.988	0.000	0.000	0.34	0.34	
	High	55	4.25	1.004			0.44	0.45	0.12
	Total	498	3.95	1.089					
B2	None	60	3.18	1.017					
	Little	193	3.66	.967			0.47		
	Sufficient	180	3.87	1.014	0.000	0.000	0.68	0.21	
	High	54	4.09	1.217			0.75	0.36	0.18
	Total	487	3.73	1.047					
B3	None	60	3.43	1.240					
	Little	195	3.32	1.123			0.09		
	Sufficient	179	3.27	1.165	0.125	0.194	0.13	0.04	
	High	53	3.70	1.324			0.20	0.28	0.32
	Total	487	3.36	1.179					
B4	None	58	3.07	1.137					
	Little	193	3.37	1.044			0.27		
	Sufficient	183	3.46	1.137	0.138	0.151	0.34	0.08	
	High	55	3.27	1.420			0.14	0.07	0.13
	Total	489	3.36	1.140					
B5	None	48	3.31	1.240					
	Little	171	3.68	.992			0.29		
	Sufficient	178	3.93	.874	0.000	0.002	0.50	0.26	
	High	55	4.00	1.036			0.55	0.31	0.07
	Total	452	3.78	1.001					
B6	None	60	3.95	1.227					
	Little	197	4.14	1.003			0.15		
	Sufficient	184	4.24	.893	0.178	0.236	0.24	0.11	
	High	55	4.00	1.305			0.04	0.11	0.19
	Total	496	4.14	1.034					
B7	None	59	4.24	1.040					
	Little	193	4.24	.951			0.01		
	Sufficient	181	4.39	.885	0.373	0.378	0.14	0.15	
	High	54	4.41	.922			0.16	0.17	0.02
	Total	487	4.31	.935					
B8	None	61	3.85	1.340					
	Little	196	3.96	1.109			0.08		
	Sufficient	185	4.09	1.028	0.203	0.256	0.17	0.11	
	High	56	4.23	1.160			0.28	0.24	0.13
	Total	498	4.02	1.118					
B9	None	57	3.67	1.327					
	Little	197	3.52	1.240			0.11		
	Sufficient	185	3.63	1.366	0.587	0.599	0.03	0.08	
	High	55	3.78	1.410			0.08	0.18	0.11
	Total	494	3.61	1.316					
B10	None	60	3.42	1.430					
	Little	197	3.71	1.260			0.20		
	Sufficient	182	3.90	1.135	0.055	0.086	0.34	0.15	
	High	56	3.88	1.280			0.32	0.13	0.02
	Total	495	3.76	1.246					
B11	None	61	3.89	1.266					
	Little	194	4.17	1.001			0.22		
	Sufficient	181	4.30	.919	0.036	0.910	0.33	0.13	
	High	54	4.33	1.099			0.35	0.15	0.03
	Total	490	4.20	1.026					
B12	None	59	3.93	1.472					
	Little	193	4.25	1.026			0.21		
	Sufficient	179	4.31	.996	0.073	0.214	0.26	0.06	
	High	55	4.42	1.066			0.33	0.16	0.10
	Total	486	4.25	1.088					
B13	None	61	2.18	1.489					
	Little	196	2.36	1.445			0.12		
	Sufficient	181	2.58	1.542	0.209	0.221	0.26	0.14	
	High	54	2.59	1.584			0.26	0.15	0.01
	Total	492	2.44	1.505					
B14	None	61	2.11	1.404					
	Little	199	2.40	1.484			0.19		
	Sufficient	181	2.58	1.524	0.120	0.110	0.31	0.12	
	High	56	2.68	1.585			0.36	0.17	0.06
	Total	497	2.46	1.505					
B15	None	48	3.21	1.398					
	Little	179	2.98	1.390			0.16		
	Sufficient	180	3.18	1.346	0.525	0.519	0.02	0.14	
	High	52	3.06	1.589			0.09	0.05	0.08
	Total	459	3.09	1.397					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.8a continued

Knowledge of wastewater reuse		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
C1	None	62	4.10	1.238					
	Little	196	3.95	1.162			0.12		
	Sufficient	183	3.74	1.295	0.036	0.046	0.28	0.16	
	High	57	4.21	1.221			0.09	0.21	0.36
	Total	498	3.92	1.236					
C2	None	62	3.19	1.265					
	Little	192	3.02	1.146			0.14		
	Sufficient	181	3.07	1.236	0.755	0.774	0.10	0.04	
	High	54	2.98	1.434			0.15	0.02	0.06
	Total	489	3.05	1.227					
C3	None	60	2.63	1.377					
	Little	193	2.46	1.254			0.13		
	Sufficient	179	2.25	1.197	0.166	0.180	0.28	0.17	
	High	55	2.40	1.355			0.17	0.04	0.11
	Total	487	2.39	1.264					
C4	None	63	3.37	1.336					
	Little	191	3.02	1.196			0.26		
	Sufficient	182	3.07	1.171	0.269	0.334	0.22	0.04	
	High	57	3.02	1.433			0.24	0.00	0.04
	Total	493	3.08	1.236					
C5	None	61	3.54	1.246					
	Little	188	3.07	1.193			0.38		
	Sufficient	175	3.26	1.249	0.079	0.073	0.23	0.15	
	High	54	3.20	1.497			0.23	0.09	0.04
	Total	478	3.21	1.262					
D1	None	62	3.56	1.456					
	Little	193	3.85	1.075			0.20		
	Sufficient	181	3.94	1.060	0.010	0.018	0.26	0.08	
	High	58	4.24	.997			0.47	0.36	0.28
	Total	494	3.89	1.126					
D2	None	60	3.87	1.241					
	Little	195	4.04	1.022			0.14		
	Sufficient	181	4.01	1.014	0.400	0.455	0.11	0.03	
	High	56	4.20	1.017			0.27	0.16	0.19
	Total	492	4.02	1.048					
D3	None	59	3.61	1.462					
	Little	191	3.94	1.125			0.23		
	Sufficient	182	4.20	.989	0.001	0.003	0.40	0.23	
	High	55	4.33	1.090			0.49	0.34	0.12
	Total	487	4.04	1.136					
D4	None	60	3.40	1.554					
	Little	190	3.12	1.338			0.18		
	Sufficient	178	3.10	1.283	0.106	0.150	0.20	0.02	
	High	55	3.53	1.464			0.08	0.28	0.29
	Total	483	3.19	1.366					
D5	None	58	3.36	1.518					
	Little	187	3.20	1.283			0.10		
	Sufficient	182	3.47	1.150	0.001	0.001	0.07	0.21	
	High	55	3.96	1.201			0.40	0.59	0.41
	Total	482	3.41	1.274					
D6	None	61	3.18	1.443					
	Little	187	3.11	1.284			0.05		
	Sufficient	182	3.42	1.153	0.056	0.058	0.17	0.24	
	High	55	3.49	1.289			0.22	0.29	0.05
	Total	485	3.28	1.264					
D7	None	58	3.07	1.437					
	Little	189	3.20	1.220			0.09		
	Sufficient	176	3.36	1.066	0.298	0.302	0.21	0.14	
	High	54	3.13	1.347			0.04	0.05	0.17
	Total	477	3.23	1.211					
D8	None	53	2.89	1.577					
	Little	151	2.51	1.496			0.24		
	Sufficient	129	2.02	1.244	0.000	0.000	0.55	0.33	
	High	40	1.98	1.368			0.58	0.36	0.03
	Total	373	2.34	1.443					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.8a continued

Knowledge of wastewater reuse		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
D11	None	60	3.85	1.363					
	Little	194	3.28	1.353			0.42		
	Sufficient	183	3.22	1.274	0.015	0.019	0.46	0.05	
	High	56	3.30	1.464			0.37	0.01	0.06
	Total	493	3.33	1.349					
D12	None	60	3.45	1.281					
	Little	190	3.36	1.301			0.07		
	Sufficient	182	3.30	1.227	0.521	0.545	0.12	0.05	
	High	55	3.58	1.343			0.10	0.16	0.21
	Total	487	3.38	1.275					
D13	None	58	3.93	1.168					
	Little	184	3.72	1.128			0.18		
	Sufficient	180	3.92	.936	0.229	0.256	0.01	0.18	
	High	54	3.96	1.197			0.03	0.20	0.03
	Total	476	3.85	1.074					
D14	None	59	3.93	1.324					
	Little	191	3.96	1.033			0.02		
	Sufficient	183	4.17	.907	0.213	0.190	0.18	0.20	
	High	55	4.05	1.113			0.09	0.08	0.10
	Total	488	4.05	1.039					
D15	None	58	3.38	1.349					
	Little	192	3.41	1.074			0.02		
	Sufficient	182	3.47	1.121	0.570	0.626	0.07	0.06	
	High	55	3.64	1.253			0.19	0.18	0.13
	Total	487	3.45	1.146					
D16	None	60	3.30	1.357					
	Little	190	3.54	1.153			0.17		
	Sufficient	179	3.81	.953	0.011	0.015	0.38	0.24	
	High	55	3.69	1.230			0.29	0.13	0.10
	Total	484	3.63	1.131					
E1	None	60	3.12	1.462					
	Little	197	3.25	1.361			0.09		
	Sufficient	182	3.61	1.206	0.021	0.020	0.34	0.27	
	High	58	3.47	1.513			0.23	0.14	0.10
	Total	497	3.39	1.347					
E2	None	60	2.50	1.242					
	Little	193	2.44	1.202			0.05		
	Sufficient	182	2.82	1.199	0.018	0.018	0.26	0.32	
	High	56	2.73	1.421			0.16	0.21	0.06
	Total	491	2.62	1.242					
E3	None	61	2.52	1.273					
	Little	193	2.46	1.220			0.05		
	Sufficient	182	2.71	1.201	0.040	0.062	0.15	0.21	
	High	56	2.95	1.445			0.29	0.34	0.16
	Total	492	2.62	1.254					
F1	None	63	3.86	1.268					
	Little	193	3.91	1.253			0.04		
	Sufficient	179	4.00	1.117	0.409	0.354	0.11	0.07	
	High	56	4.18	1.029			0.25	0.21	0.16
	Total	491	3.97	1.183					
F2	None	60	2.47	1.295					
	Little	191	2.88	1.289			0.32		
	Sufficient	181	3.08	1.213	0.003	0.005	0.47	0.15	
	High	56	3.25	1.405			0.56	0.26	0.12
	Total	488	2.95	1.290					
F3	None	61	3.00	1.291					
	Little	189	3.18	1.207			0.14		
	Sufficient	177	3.31	1.091	0.319	0.355	0.24	0.10	
	High	55	3.31	1.303			0.24	0.10	0.00
	Total	482	3.22	1.189					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.8b: Descriptive statistics and medium effect size for wastewater reuse knowledge

Knowledge of wastewater reuse		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B2	None	60	3.18	1.017					
	Little	193	3.66	.967			0.47		
	Sufficient	180	3.87	1.014	0.000	0.000	0.68	0.21	
	High	54	4.09	1.217			0.75	0.36	0.18
	Total	487	3.73	1.047					
B5	None	48	3.31	1.240					
	Little	171	3.68	.992			0.29		
	Sufficient	178	3.93	.874	0.000	0.002	0.50	0.26	
	High	55	4.00	1.036			0.55	0.31	0.07
	Total	452	3.78	1.001					
D1	None	62	3.56	1.456					
	Little	193	3.85	1.075			0.20		
	Sufficient	181	3.94	1.060	0.010	0.018	0.26	0.08	
	High	58	4.24	.997			0.47	0.36	0.28
	Total	494	3.89	1.126					
D5	None	58	3.36	1.518					
	Little	187	3.20	1.283			0.10		
	Sufficient	182	3.47	1.150	0.001	0.001	0.07	0.21	
	High	55	3.96	1.201			0.40	0.59	0.41
	Total	482	3.41	1.274					
D8	None	53	2.89	1.577					
	Little	151	2.51	1.496			0.24		
	Sufficient	129	2.02	1.244	0.000	0.000	0.55	0.33	
	High	40	1.98	1.368			0.58	0.36	0.03
	Total	373	2.34	1.443					
F2	None	60	2.47	1.295					
	Little	191	2.88	1.289					
	Sufficient	181	3.08	1.213	0.003	0.005	0.47	0.15	
	High	56	3.25	1.405			0.56	0.26	0.12
	Total	488	2.95	1.290					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.3.6 Knowledge of water scarcity

Tables 3.9a & b show the results of the mean values calculated for the dimensions based on knowledge of water scarcity as well as the effect size results. Research shows that respondents with little or no knowledge of wastewater reuse tend to have more negative perceptions than those with more knowledge (Dolnicar *et al*., 2011:935). The effect size calculations indicate that medium or practically visible differences were observed for questions B1, B2, B5, D3, D8, D11, E1, E2, F1 and F2 (Table 3.9b). These questions show differences in knowledge of wastewater reuse, sources of information used and types of water to be recycled.

Table 3.9a: Descriptive statistics and effect size results based on employment level

A 8: Knowledge of water scarcity		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B1	None	59	3.51	1.165					
	Little	157	3.75	1.165			0.20		
	Sufficient	194	4.11	.964	0.000	0.000	0.52	0.32	
	High	87	4.24	1.011			0.63	0.43	0.13
	Total	497	3.95	1.089					
B2	None	58	3.26	1.069					
	Little	153	3.61	.988			0.33		
	Sufficient	188	3.89	.997	0.000	0.000	0.59	0.29	
	High	87	3.89	1.135			0.55	0.24	0.01
	Total	486	3.73	1.048					
B3	None	58	3.40	1.242					
	Little	152	3.37	1.143			0.02		
	Sufficient	190	3.25	1.154	0.287	0.316	0.12	0.10	
	High	86	3.55	1.252			0.12	0.14	0.23
	Total	486	3.36	1.180					
B4	None	55	3.18	1.107					
	Little	151	3.33	1.075			0.13		
	Sufficient	194	3.43	1.160	0.526	0.517	0.22	0.09	
	High	88	3.36	1.224			0.15	0.03	0.06
	Total	488	3.36	1.140					
B5	None	43	3.33	1.210					
	Little	132	3.57	1.043			0.20		
	Sufficient	189	3.93	.872	0.000	0.000	0.50	0.34	
	High	87	4.00	.976			0.56	0.41	0.08
	Total	451	3.78	1.002					
B7	None	55	4.20	1.112					
	Little	152	4.24	.947			0.03		
	Sufficient	193	4.38	.871	0.374	0.398	0.16	0.15	
	High	86	4.36	.932			0.14	0.13	0.02
	Total	486	4.31	.936					
B8	None	56	3.75	1.365					
	Little	158	3.94	1.149			0.14		
	Sufficient	196	4.11	1.030	0.081	0.129	0.26	0.15	
	High	87	4.16	1.055			0.30	0.20	0.05
	Total	497	4.02	1.119					
B9	None	53	3.64	1.302					
	Little	156	3.53	1.287			0.08		
	Sufficient	196	3.68	1.337	0.707	0.710	0.03	0.11	
	High	88	3.55	1.347			0.07	0.01	0.10
	Total	493	3.61	1.317					
B10	None	58	3.43	1.416					
	Little	153	3.61	1.299			0.12		
	Sufficient	195	3.89	1.161	0.014	0.023	0.32	0.22	
	High	88	3.95	1.164			0.37	0.27	0.06
	Total	494	3.76	1.247					
B11	None	59	3.80	1.270					
	Little	152	4.13	1.046			0.26		
	Sufficient	193	4.30	.931	0.003	0.012	0.40	0.16	
	High	85	4.38	.938			0.46	0.23	0.08
	Total	489	4.20	1.027					
B12	None	57	3.96	1.426					
	Little	151	4.22	1.045			0.18		
	Sufficient	191	4.28	1.028	0.076	0.147	0.22	0.06	
	High	86	4.44	1.013			0.33	0.21	0.15
	Total	485	4.25	1.089					
B13	None	58	2.22	1.499					
	Little	154	2.38	1.539			0.10		
	Sufficient	193	2.54	1.482	0.482	0.481	0.21	0.11	
	High	86	2.49	1.509			0.18	0.07	0.04
	Total	491	2.44	1.506					
B14	None	58	2.24	1.514					
	Little	158	2.42	1.548			0.11		
	Sufficient	192	2.57	1.488	0.509	0.512	0.22	0.10	
	High	88	2.47	1.470			0.15	0.03	0.07
	Total	496	2.46	1.506					
B15	None	45	3.16	1.381					
	Little	140	3.14	1.412			0.01		
	Sufficient	189	3.15	1.360	0.362	0.400	0.01	0.00	
	High	84	2.85	1.460			0.21	0.20	0.21
	Total	458	3.09	1.397					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.9a continued

A 8: Knowledge of water scarcity		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
C1	None	58	3.84	1.399					
	Little	154	3.97	1.207			0.09		
	Sufficient	194	3.87	1.191	0.796	0.804	0.02	0.08	
	High	91	3.99	1.287			0.10	0.02	0.09
	Total	497	3.92	1.237					
C2	None	57	3.28	1.236					
	Little	151	3.06	1.133			0.18		
	Sufficient	191	3.01	1.250	0.503	0.517	0.22	0.04	
	High	89	3.01	1.327			0.20	0.04	0.00
	Total	488	3.06	1.227					
C3	None	57	2.70	1.439					
	Little	149	2.62	1.228			0.06		
	Sufficient	191	2.21	1.188	0.003	0.005	0.34	0.33	
	High	89	2.21	1.292			0.34	0.31	0.00
	Total	486	2.40	1.265					
C4	None	58	3.38	1.349					
	Little	150	3.03	1.176			0.26		
	Sufficient	194	3.03	1.182	0.262	0.326	0.26	0.00	
	High	90	3.10	1.366			0.20	0.05	0.05
	Total	492	3.08	1.237					
C5	None	57	3.65	1.261					
	Little	146	3.12	1.203			0.42		
	Sufficient	187	3.17	1.235	0.049	0.052	0.38	0.03	
	High	87	3.18	1.385			0.34	0.04	0.01
	Total	477	3.21	1.264					
D1	None	58	3.62	1.387					
	Little	152	3.88	1.097			0.19		
	Sufficient	194	3.90	1.085	0.119	0.184	0.20	0.02	
	High	90	4.08	1.052			0.33	0.18	0.16
	Total	494	3.89	1.126					
D2	None	59	3.90	1.170					
	Little	150	4.09	1.012			0.17		
	Sufficient	194	3.97	1.035	0.514	0.540	0.06	0.12	
	High	88	4.09	1.057			0.16	0.00	0.11
	Total	491	4.02	1.049					
D3	None	55	3.40	1.547					
	Little	152	3.90	1.167			0.32		
	Sufficient	191	4.14	.987	0.000	0.000	0.48	0.21	
	High	88	4.47	.857			0.69	0.48	0.33
	Total	486	4.04	1.137					
D4	None	58	3.41	1.511					
	Little	149	3.30	1.374			0.07		
	Sufficient	190	3.02	1.285	0.136	0.140	0.26	0.20	
	High	86	3.23	1.403			0.12	0.05	0.15
	Total	483	3.19	1.366					
D5	None	52	3.25	1.532					
	Little	148	3.37	1.295			0.08		
	Sufficient	195	3.31	1.193	0.018	0.140	0.04	0.05	
	High	87	3.79	1.192			0.35	0.33	0.40
	Total	482	3.41	1.274					
D6	None	57	3.19	1.469					
	Little	148	3.25	1.298			0.04		
	Sufficient	194	3.29	1.191	0.846	0.860	0.07	0.03	
	High	86	3.37	1.237			0.12	0.09	0.07
	Total	485	3.28	1.264					
D7	None	55	3.16	1.463					
	Little	150	3.28	1.238			0.08		
	Sufficient	186	3.25	1.117	0.890	0.904	0.06	0.03	
	High	86	3.17	1.200			0.01	0.09	0.06
	Total	477	3.23	1.211					
D8	None	50	2.92	1.536					
	Little	124	2.63	1.559			0.19		
	Sufficient	137	1.88	1.153	0.000	0.000	0.68	0.48	
	High	62	2.29	1.419			0.41	0.22	0.29
	Total	373	2.34	1.443					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.9a continued

A 8: Knowledge of water scarcity		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
D11	None	57	3.88	1.211					
	Little	151	3.46	1.326			0.31		
	Sufficient	196	3.18	1.341	0.001	0.001	0.52	0.21	
	High	88	3.09	1.395			0.56	0.27	0.06
	Total	492	3.33	1.350					
D12	None	55	3.62	1.225					
	Little	149	3.47	1.271			0.12		
	Sufficient	195	3.25	1.285	0.183	0.178	0.29	0.17	
	High	87	3.34	1.283			0.21	0.10	0.08
	Total	486	3.37	1.276					
D13	None	52	3.85	1.073					
	Little	147	3.78	1.202			0.05		
	Sufficient	191	3.93	.965	0.630	0.621	0.08	0.12	
	High	85	3.80	1.089			0.04	0.01	0.12
	Total	475	3.85	1.076					
D14	None	54	4.00	1.259					
	Little	151	3.89	1.090			0.08		
	Sufficient	195	4.17	.906	0.107	0.098	0.13	0.25	
	High	87	4.06	1.060			0.05	0.15	0.11
	Total	487	4.05	1.039					
D15	None	56	3.41	1.262					
	Little	150	3.49	1.174			0.06		
	Sufficient	194	3.44	1.062	0.966	0.969	0.02	0.04	
	High	86	3.48	1.215			0.05	0.01	0.03
	Total	486	3.46	1.146					
D16	None	57	3.21	1.398					
	Little	147	3.59	1.186			0.27		
	Sufficient	193	3.75	.970	0.016	0.052	0.38	0.13	
	High	86	3.69	1.130			0.34	0.08	0.05
	Total	483	3.63	1.132					
E1	None	57	2.91	1.550					
	Little	154	3.18	1.382			0.17		
	Sufficient	194	3.66	1.169	0.000	0.000	0.48	0.35	
	High	91	3.47	1.393			0.36	0.21	0.13
	Total	496	3.39	1.348					
E2	None	57	2.21	1.161					
	Little	151	2.42	1.208			0.18		
	Sufficient	193	2.78	1.224	0.001	0.001	0.46	0.29	
	High	89	2.88	1.286			0.52	0.35	0.08
	Total	490	2.62	1.241					
E3	None	57	2.47	1.297					
	Little	152	2.47	1.228			0.01		
	Sufficient	194	2.64	1.205	0.059	0.800	0.13	0.14	
	High	88	2.90	1.339			0.32	0.32	0.19
	Total	491	2.62	1.254					
F1	None	59	3.49	1.382					
	Little	153	3.92	1.275			0.31		
	Sufficient	191	4.05	1.077	0.003	0.008	0.40	0.10	
	High	87	4.20	1.010			0.51	0.21	0.14
	Total	490	3.97	1.184					
F2	None	57	2.54	1.283					
	Little	150	2.69	1.274			0.12		
	Sufficient	193	3.08	1.254	0.000	0.000	0.42	0.30	
	High	87	3.36	1.267			0.63	0.52	0.22
	Total	487	2.95	1.291					
F3	None	57	3.04	1.267					
	Little	148	3.13	1.241			0.07		
	Sufficient	191	3.29	1.079	0.328	0.357	0.20	0.13	
	High	85	3.32	1.265			0.22	0.15	0.02
	Total	481	3.21	1.188					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

Table 3.9b: Descriptive statistics and medium effect size for water scarcity knowledge

A 8: Knowledge of water scarcity		N	Mean	Std. Deviation	p-value (ANOVA)	p-value (Welch)	Effect sizes		
							1 with	2 with ...	3 with .....
B1	None	59	3.51	1.165	0.000	0.000			
	Little	157	3.75	1.165			0.20		
	Sufficient	194	4.11	.964			0.52	0.32	
	High	87	4.24	1.011			0.63	0.43	0.13
	Total	497	3.95	1.089					
B2	None	58	3.26	1.069	0.000	0.000			
	Little	153	3.61	.988			0.33		
	Sufficient	188	3.89	.997			0.59	0.29	
	High	87	3.89	1.135			0.55	0.24	0.01
	Total	486	3.73	1.048					
B5	None	43	3.33	1.210	0.000	0.000			
	Little	132	3.57	1.043			0.20		
	Sufficient	189	3.93	.872			0.50	0.34	
	High	87	4.00	.976			0.56	0.41	0.08
	Total	451	3.78	1.002					
D3	None	55	3.40	1.547	0.000	0.000			
	Little	152	3.90	1.167			0.32		
	Sufficient	191	4.14	.987			0.48	0.21	
	High	88	4.47	.857			0.69	0.48	0.33
	Total	486	4.04	1.137					
D8	None	50	2.92	1.536	0.000	0.000			
	Little	124	2.63	1.559			0.19		
	Sufficient	137	1.88	1.153			0.68	0.48	
	High	62	2.29	1.419			0.41	0.22	0.29
	Total	373	2.34	1.443					
D11	None	57	3.88	1.211	0.001	0.001			
	Little	151	3.46	1.326			0.31		
	Sufficient	196	3.18	1.341			0.52	0.21	
	High	88	3.09	1.395			0.56	0.27	0.06
	Total	492	3.33	1.350					
E1	None	57	2.91	1.550	0.000	0.000			
	Little	154	3.18	1.382			0.17		
	Sufficient	194	3.66	1.169			0.48	0.35	
	High	91	3.47	1.393			0.36	0.21	0.13
	Total	496	3.39	1.348					
E2	None	57	2.21	1.161	0.001	0.001			
	Little	151	2.42	1.208			0.18		
	Sufficient	193	2.78	1.224			0.46	0.29	
	High	89	2.88	1.286			0.52	0.35	0.08
	Total	490	2.62	1.241					
F1	None	59	3.49	1.382	0.003	0.008			
	Little	153	3.92	1.275			0.31		
	Sufficient	191	4.05	1.077			0.40	0.10	
	High	87	4.20	1.010			0.51	0.21	0.14
	Total	490	3.97	1.184					
F2	None	57	2.54	1.283	0.000	0.000			
	Little	150	2.69	1.274			0.12		
	Sufficient	193	3.08	1.254			0.42	0.30	
	High	87	3.36	1.267			0.63	0.52	0.22
	Total	487	2.95	1.291					

***p-values are reported for completeness and will not be interpreted since a convenience sample was used instead of a random sample**

3.4 QUALITATIVE RESULTS ANALYSIS

In addition to the above quantitative assessment, respondents were asked qualitative information where they had to state their opinions on any aspects of concern on wastewater reuse. The responses of the respondents are tabulated in Table 3.10 below.

Table 3.10: Qualitative study questions and responses

B16	Please indicate other uses you may be willing to use wastewater for	• Generate electricity • Construction of buildings
C7	Please list any other reasons why you are concerned about wastewater reuse	• Poor management at the plant • Chemicals used to treat it • Quality of the water • Lack of adequate revenues necessary to produce safe water due to corruption.
D10	Please list any other information sources you use to access information on environmental issues	• Place of work • Research papers
D17	Please list any other institution whose opinion you trust on wastewater reuse	Research papers
E5	Please state any other source of wastewater you would prefer to use	• Rainwater • Boreholes • Acid mine water
G	State any comments you may have on wastewater reuse	
• Can be used for other purposes but not for drinking • Will use it if a reputable company is in charge • A good idea as it will combat water scarcity, will minimize water scarcity • Must be done properly: water to meet standards i.e. good quality, process monitored adequately • People need more information on the topic • Must be safe for human consumption, guaranteed safety • Will use it because water is scarce, better to have wastewater than no water at all • Is a good initiative • I see no difference between using wastewater and water from dams etc • Will assist in water saving • Will accept depending on final water quality • Wastewater from industry must be used to avoid sicknesses and health hazards • Will need high technology to work • A big no on wastewater reuse • OK as long as it is not for direct human use i.e. cooking, drinking or swimming • Concerned about pollutants which cannot be removed by the treatment processes • I prefer not to know about the fact that I am using wastewater, it is not comfortable to know • I don't have confidence that the water will be pure • I don't trust wastewater • Wastewater reuse has not reached its full potential due to tendency of emphasizing health risks over other benefits Lack of adequate information disseminated to the general public • More educational drives/awareness programs need to be put in place to educate people on wastewater reuse		

The results of the qualitative study indicate that most of the respondents are not against wastewater reuse if it is used for functions other than cooking or drinking. This is mostly due to factors such as concern over quality of water as a result of poor workmanship, lack of skills and lack of resources necessary to treat water to acceptable standards. Some of the responses of the respondents are as follows:

“I need to be reassured that the water treatment plants work efficiently as I have witnessed health related problems from using water that is not properly cleaned.”

“Treated water must be used for other purposes but not for drinking and cooking purposes.”

“I would trust using treated wastewater on condition that a reputable company manages it.”

A number of respondents were of the opinion that wastewater reuse is a good initiative as it will minimize water scarcity. Additionally, some the respondents expressed the dire need for consumers to be educated on wastewater reuse.

According to Denzin and Lincoln (1994:4) as cited in Welman *et al*. (2007:8), the qualitative study is to ascertain the socially constructed nature of the respondents’ reality. The respondents repeatedly stated their disapproval of using wastewater for functions that are closer to humans, mistrust of wastewater treatment works’ ability to produce good quality water and the need for educational awareness on wastewater reuse. The concerns raised must be addressed when implementing wastewater reuse projects in the Vaal Triangle area.

CHAPTER 4: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

The aim of this chapter is to provide conclusions regarding the results obtained in this study. Conclusions will be drawn with regard to the problem statement and research objectives of this study. The primary objective of this study was to assess the perceptions of water consumers within the Vaal Triangle area on wastewater reuse. To achieve the primary objective, secondary objectives were determined and analysed throughout the study by looking at literature on perceptions on wastewater reuse, designing a questionnaire to assess perceptions of consumers in the Vaal Triangle area, assessing the questionnaire to ascertain the perceptions of consumers.

4.1 SUMMARY OF FINDINGS

The literature review of prior research into public perceptions of consumers revealed that wastewater reuse projects often fail because of resistance of consumers (Adewumi, *et al*., 2014:11-19; Stoakley, 2013:1-20) and their negative perceptions towards wastewater reuse. Hence assessing public perceptions and addressing them is recommended for successful implementation of wastewater reuse projects.

Some of the factors identified in the literature that affect consumers' perceptions on wastewater reuse are education, age, knowledge or information on wastewater reuse, gender, occupation, trust in the service provider, health concerns, perception of good water quality (Dolnicar & Hurlimann, 2010:6; Niekerk & Schneider, 2013:13; Wilson & Pfaff, 2008:1-9). These factors were included in the empirical study and the following are the conclusions of the findings:

- ***Education*** **-** the study found that education affects the perceptions on wastewater reuse. The more educated the respondents the more favourable they were towards wastewater reuse. As a result, Dolnicar and Schafer (2006:5) proposed the introduction of wastewater reuse in high-status communities first. It is important to note that while education leads to more favourable perceptions on wastewater reuse, it can result in

those who oppose becoming strongly opposed and vice versa if there is uncertainty regarding safety, trust and other factors that may jeopardize the quality of water.

- **Age** - this study showed that younger people tend to have more negative perceptions of wastewater reuse that older people. Younger people had little or no knowledge of wastewater reuse and water scarcity, hence the negative perceptions. This is an indication that strategies to overcome negative perceptions should address the needs or gaps of the different age groups.
- ***Knowledge of wastewater reuse*** has been found to be one of the factors influencing perceptions on wastewater reuse in this study as has been reported in literature. Additionally, a significant number of respondents stated through the qualitative study that they needed more knowledge on wastewater reuse. Information sharing and educational activities can increase the support of wastewater reuse.
- ***Race***: literature indicates that race has a more powerful influence on perceptions towards wastewater reuse than other demographic factors (Hartley, 2003:A15). Some beliefs and values are associated with a certain race in terms of a higher degree of mistrust and suspicion in the government (Hartley, 2003:A15). In this study differences were seen in perceptions of different races where White respondents were more negative in terms of trusting the authorities than Black respondents.
- ***Gender*** has been reported to be one of the factors affecting perceptions of wastewater reuse with males being more favourable. This study found no significant differences between the perceptions of males and females.
- ***Level of employment*** has been found to influence the perceptions on wastewater reuse in this study as has been reported in literature. Unemployed respondents were less favourable to wastewater reuse than the employed respondents.
- ***Most acceptable wastewater reuse options*** were identified in the study. These are uses with minimal contact with humans i.e.
    - Industry use
    - Fire fighting
    - Washing cars
    - Washing clothes

    - Watering vegetable gardens: to a lesser extent than other uses
    - Watering lawns and golf courses
    - Flushing toilets
    - Electricity generation
    - Construction of buildings
- ***Least acceptable uses*** identified in the study are uses with direct contact with humans:
    - Cooking food
    - Drinking
    - Swimming pools
- Major barriers to public acceptance listed (in both the qualitative and quantitative studies) by respondents were:
    - Poor management at the plants
    - Chemicals used to treat wastewater
    - Quality of the final treated water
    - Lack of adequate revenues necessary to produce safe water due to corruption.
    - Lack of trust in the implementing agencies
    - Public health and safety concerns

In addition to the factors affecting perceptions of wastewater reuse mentioned above questions on sources of information used to access environmental issues, sources of water to be recycled and types of water to be recycled were included in the study as this information will help when coming up with strategies for managing the perceptions of the consumers. The summary of the findings of these is as follows:

- ***Sources used to access information*** – the majority of the respondents agreed to using newspapers and magazines, television and internet. Academic institutions and published articles are being used to a lesser extent by the more educated respondents. Environmental groups and family and friends are used to the least extent by respondents.

- ***Sources of water to be recycled –*** the overall response of the respondents was unfavourable about using wastewater from their own neighbourhood and the whole city and more favourable about using water from own households. This is in agreement with literature findings (Jeffrey, 2002:214; Nancarrow *et al*., 2009:3199) where the respondents preferred to use wastewater whose origin was known to them.
- ***Type of water to be recycled –*** overall, the respondents were more favourable about using rainwater and neutral about using grey water and wastewater. This presents an opportunity to educate people more in order to change their perceptions.

4.2 CONCLUSIONS

The conclusions regarding the objectives of the study and hypothesis are as follows:

Objective 1: Conceptualization of public perceptions on wastewater reuse by conducting a literature review of prior research into public perceptions

The literature survey revealed that wastewater reuse is one of the important water resources identified in South Africa to augment freshwater in order to deal with water scarcity (Adewumi *et al*., 2010:251; NWRS2, 2013:2). Despite significant strides made in wastewater reuse due to improved technologies (2030 WRG, 2013:112; NWRS1, 2011; NWRS2, 2013), wastewater reuse faces major resistance from the public due to negative perceptions. It is clear that negative perceptions need to be overcome for wastewater reuse projects to be successful.

Objective 2: To empirically identify factors that affect consumer's perceptions on wastewater reuse and determine the relationships between the variables and constructs that measure perceptions

In order to overcome negative perceptions, factors that affect consumers' perceptions were empirically evaluated. The study concluded that the following factors affect perceptions of consumers in the Vaal Triangle on wastewater reuse:

Socio-demographic factors: age group, race, qualification and level of employments affect the perceptions of the consumers on wastewater reuse as reported in literature (Dolnicar &

Hurlimann, 2010:6; Niekerk & Schneider, 2013:13; Wilson & Pfaff, 2008:1-9).. This indicates that strategies to overcome negative perceptions should be developed to address these issues. Gender did not have an impact in this study which is contrary to literature (Dolnicar & Hurlimann, 2010:6; Niekerk & Schneider, 2013:13; Wilson & Pfaff, 2008:1-9).

Additionally, knowledge of wastewater reuse and water scarcity had a positive effect on perceptions; hence educating people more is important.

Objective 3: To determine the reasons why consumers are/are not receptive to wastewater reuse

The study indicates that the majority of consumers are not receptive to wastewater reuse due to health reasons. Consumers also indicated psychological reasons; this is in agreement with published literature (Alhumoud & Madzikanda, 2010:141; Dolnicar *et al*., 2011:933; Marks, 2006:139). White respondents do not trust the workmanship of the plant whereas other race groups were neutral. Poor management at the plant, chemicals used to treat wastewater, quality of the water and lack of adequate revenues necessary to produce safe water due to corruption were raised as reasons for concern during the qualitative study. These need to be addressed when developing strategies to manage perceptions on wastewater reuse.

Objective 4: To assess the level of knowledge of consumers on wastewater reuse

Knowledge of wastewater reuse has been shown to affect perceptions on wastewater reuse favourably. Responses to the knowledge questions reveal gaps in the population‘s general level of knowledge as two questions were answered correctly and two incorrectly. Additionally there was contradiction when respondents were asked if reusing wastewater will cause health concerns (49.8% agreed) than when they were asked if they were concerned about reusing wastewater because of health reasons, where 70.5% agreed. Knowledge of wastewater reuse is important and may lead to acceptance of wastewater reuse projects. Additionally it can lead to the realization that wastewater use could meet economic needs such as income generation and food supply hence positive perceptions of wastewater reuse.

Objective 5: To establish the information sources used by consumers to gain information on wastewater use.

It can be concluded that most consumers use normal media (television, magazines, flyers and newspapers and internet). These should be used as they will reach a larger audience than the internet and other sources. Communication strategies should make use of consumers' preferred communication methods.

Testing of hypothesis

H1: *Respondents' knowledge of wastewater reuse will have a positive effect (acceptance) of wastewater reuse.*

According to the results in Table 10 the respondents with sufficient or high knowledge of wastewater reuse were more favourable about wastewater reuse than the groups with little or no knowledge. The hypothesis is thus accepted.

H2: *Respondents will be more accepting of wastewater reuse for uses with less physical contact*

According to the results in Figure 3.9 the respondents were more accepting of wastewater reuse for uses with less physical contact (industry use, fire fighting, washing cars, washing clothes, watering vegetable gardens, watering lawns and golf courses and flushing toilets) than uses with direct contact with humans, like cooking food, drinking and swimming pools). The hypothesis is thus accepted.

4.3 LIMITATIONS OF THE STUDY

The identified limitations of this study are as follows:

- One limitation is that the study was done using a sample of people living in the Vaal Triangle area and may not represent the perceptions of the people in the province or South Africa as a whole.

- The use of questionnaires in the present research constitutes a limitation. Interviews could help to establish and determine the underlying factors better.
- A convenience sample was taken instead of a random sample; this had an impact in the analysis of the results as some tests could not be used. This could have given a broader scope to analyse the results.
- There was low level of participation among White, Indian and Coloured respondents, hence participation of different the races was not balanced in the study.
- The questionnaires were available in English whereas most respondents' first language is not English. This may have had an influence on the interpretation of some of the questions.

4.4 RECOMMENDATIONS

Willingness to reuse treated wastewater by potential users has been shown to be critical prior to implementation of wastewater reuse projects. Hence the following recommendations are made from the study:

4.4.1 Recommendations to the implementing agencies

In order to manage perceptions on wastewater reuse and ensure success of wastewater reuse projects the following recommendations are made, based on the findings:

- Before implementation of any wastewater reuse programme perceptions of consumers should be assessed and from these assessments, strategies to overcome negative perceptions should be developed.
- Promote a voluntary spirit (bottom-up) where people familiarize themselves with recycled water rather than applying compulsory measures (top-down). This would result in a higher support as has been shown in previous studies (Dolnicar *et al*., 2011:940).
- Policy-makers (government) must also understand the conditions under which potential users will be willing to reuse wastewater. From the study, it was clear that uses that involve minimal human contact (e.g. industrial use, washing cars and others) were

preferred. Hence, it would be wise for decision-makers to first target these uses when wastewater reuse is to be implemented.

- Wastewater reuse should not be considered for direct potable reuse as this will result in negative perceptions. Potable reuse should be the last option after all the other options have been explored.
- Develop a communication strategy and adopt transparency of information as success of a wastewater reuse project depends greatly on the adopted communicative strategy and transparency of information (Dolnicar *et al*., 2011:933).
- Consumers should be educated on environmental factors all the time, not only when there is a crisis as knowledge will result in positive perceptions as well as an increase of trust in their authorities.
- Local Authorities need to increase the confidence of the consumers in them by being more transparent, engaging the consumers more, hiring skilled personnel and using appropriate technologies. Build and maintain trust to build public confidence through public outreach, education, participation and planning. Communication should be done when there is no crisis to build trust that is needed in time of crisis. In a study by Hartley (2006:115) resource management, information management, demonstrating organizational commitments were found to build trust of consumers on wastewater reuse.
- Communication should be done using the methods that will reach a large number of consumers, i.e. newspapers and magazines, television and internet as has been found in this study
- A behavioural modification approach should be applied to overcome negative perceptions by introducing wastewater reuse in high status areas first, as well as through community involvement and empowerment strategies.

4.4.2 Recommendations for future research

This study provides important information on perceptions of consumers on wastewater reuse, of utmost importance is the realization that perceptions of consumers vary depending on a number of factors. It is therefore important that the authorities assess the perceptions of

consumers in the area they plan to implement wastewater reuse in and not rely 100% on previous studies.

Regarding future research, it is recommended that a more representative sample be taken in future - in terms of race, age, education and knowledge. This will allow random sampling which will enable better application of the findings of the study.

4.5 CHAPTER SUMMARY

This chapter focused on conclusions made on theoretical and empirical objectives, the limitations of the research as well as recommendations to authorities for implementing wastewater reuse projects. Additionally, recommendations for future research were made.

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ANNEXTURE A: Demographic Profile of the Respondents

ITEM	CATEGORY	FREQUENCY	PERCENTAGE
Gender	Male	248	49.1
	Female	257	50.9
Age Group	<21	64	12.7
	21 - 30	134	26.7
	31 - 40	164	32.7
	41 - 50	89	17.7
	51 - 60	38	7.6
	> 60	13	2.6
Race	Black	388	77
	Coloured	23	4.6
	Indian	21	4.2
	White	70	13.9
	Other	2	0.4
Qualification	No formal education	59	11.6
	Matric	109	21.5
	Certificate/Diploma	112	22
	Degree	138	27.2
	Post graduate	90	17.7
Level Of Employment	Not employed	115	23.3
	Junior	112	22.8
	Middle	144	29.3
	Senior	67	13.6
	Non-management	25	5.1
	Other	29	5.9
Knowledge of wastewater reuse	No idea at all	63	12.4
	Some idea	200	39.4
	Sufficient knowledge	187	36.8
	Highly knowledgeable	58	11.4
Knowledge of water scarcity	No idea at all	59	11.6
	Some idea	159	31.4
	Sufficient knowledge	198	39.1
	Highly knowledgeable	91	17.9

ANNEXURE B: QUESTIONNAIRE

Completion of the questionnaire to be used in partial fulfillment of the requirements for the degree Masters in Business Administration (MBA) at the Potchefstroom Business School of North West University

Code number: ☐

QUESTIONNAIRE:

ASSESSING THE PERCEPTIONS OF CONSUMERS IN THE VAAL TRIANGLE ON WASTEWATER REUSE

CONTACT DETAILS:

Lelethu Bungu

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2014

Dear Participant

RESEARCH PROJECT

I am a registered final year MBA student in the Potchefstroom Business School at the North West University. As partial fulfillment of my MBA degree, I am currently conducting a research project for a mini dissertation. The title of my research is "**Assessing the perceptions of consumers in the Vaal triangle on wastewater reuse**"

The aim of the study is to determine the perceptions (attitudes) of water consumers on water reuse. This may help in developing strategies for educating the consumers (public involvement and participation) and gaining their trust on wastewater reuse.

I hereby request your participation in my study by completing the attached questionnaire. All information will be STRICTLY CONFIDENTIAL and will be used for ACADEMIC PURPOSES ONLY. Your contribution to the study will be highly appreciated, as the study's success is dependent on the number of participants who are willing to partake.

It would be greatly appreciated if the questionnaires be returned as swiftly as possible, not exceeding four days after the distribution date. Feedback to the institution, in the form of a dissertation, will be done as soon as the statistical analyses are finalized.

The questionnaire will take 10-20 minutes to complete.

Thank you for investing your time and effort into my study.

Should you have any queries regarding the study do not hesitate to contact me or my study leader:

Researcher:	**Lelethu Bungu**	**Cell: 0824851628**	**E-mail: lelethub@gmail.com**
Promoter/study leader:	**Prof Christoff Botha**	**Tel: 0182991409**	**Email: Christoff.botha @nwu.ac.za**

Thank you for your participation

All information is **STRICTLY CONFIDENTIAL** and will only be used for **ACADEMIC PURPOSES.**

GENERAL INSTRUCTIONS:

1. Please answer the questions as objectively and honestly as possible
2. Please answer all the questions, as this will provide more information to the researcher so that an accurate analysis and interpretation of data can be made.

WASTEWATER refers to "any water that has been adversely affected in quality by human use and therefore contains waste products, for example water that has been used for bathing, washing clothes, flushing toilets, used in a manufacturing process e.g. sewage, industrial effluent,

WASTEWATER REUSE refers to "wastewater that is treated to remove solids and certain impurities, the level of treatment determines the use reuse of the treated water. This water can be used for irrigation, sent back to the environment (dam, river etc), potable use (drinking, washing bodies and others) depending on the treatment system and quality of water produced.

SECTION A: DEMOGRAPHIC INFORMATION

A1	**Gender**	Male	Female

A2	**Age group**	<21	21 - 30	31 - 40	41 - 50	51 - 60	> 60

A3	**Race**	Black	Coloured	Indian	White	Other

A4	**Qualification**	Below Matric	Matric	Diploma / Degree	Postgraduate

A5	**Level of Employment**	Junior	Middle	Senior	Not Employed	Other

A6	If Other, please comment:

A7	**Knowledge of wastewater reuse**	No idea at all	Some idea	Sufficient knowledge	Highly knowledgeable

A8	**Knowledge of water scarcity**	No idea at all	Some idea	Sufficient knowledge	Highly knowledgeable

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SECTION B: ATTITUDES TOWARDS REUSING WASTEWATER:						
	Reusing wastewater:					
B1	Is being environmentally responsible	1	2	3	4	5
B2	Reduces the amount of pollutants discharged in the environment	1	2	3	4	5
B3	Will cause health concerns	1	2	3	4	5
B4	Will reduce the need to expand wastewater treatment plants to meet growing population needs	1	2	3	4	5
B5	Will bring economic benefits to the community	1	2	3	4	5
To what extent would you agree if a treated wastewater programme were to be implemented for:						
B6	Industry use	1	2	3	4	5
B7	Fire fighting	1	2	3	4	5
B8	Washing cars	1	2	3	4	5
B9	Washing clothes	1	2	3	4	5
B10	Watering vegetable gardens	1	2	3	4	5
B11	Watering lawns and golf courses	1	2	3	4	5
B12	Flushing toilets	1	2	3	4	5
B13	Cooking food	1	2	3	4	5
B14	Drinking	1	2	3	4	5
B15	Swimming pools	1	2	3	4	5
B16: Please indicate other uses you may be willing to use wastewater for:_____ _____						
SECTION C: I am concerned about using treated waste water because of						
C1	Health reasons	1	2	3	4	5
C2	Psychological reasons	1	2	3	4	5
C3	Religious beliefs	1	2	3	4	5
C4	I do not trust the workmanship (skills of employees) of the plants	1	2	3	4	5
C5	Due to fear of mechanical breakdowns	1	2	3	4	5
C6	Other reasons (Please mention them below and rate here)	1	2	3	4	5
C7: Please list the reasons if you selected other above:_____ _____						
SECTION D: Which information source do you use to access information about environmental issues?						
D1	Newspapers	1	2	3	4	5
D2	Television	1	2	3	4	5
D3	Internet	1	2	3	4	5
D4	Municipal offices/other government agencies	1	2	3	4	5
D5	Universities or other academic institutions	1	2	3	4	5

D6	Environmental groups	1	2	3	4	5
D7	Friends and family	1	2	3	4	5
D8	Never use any of the above	1	2	3	4	5
D9	Other	1	2	3	4	5
D10: If marked other above, please comment on these_____						
Whose opinions about a proposal to reuse purified wastewater would you trust the most?						
D11	Local Municipalities					
D12	Provincial/National Government					
D13	Water Utilities					
D14	Experts/ University Professors					
D15	Media (newspapers, TV)					
D16	Internet					
D17	Other					
D18: If marked other above, please comment on these:_____						
SECTION E: Sources of water to be recycled						
E1	I would prefer to use wastewater from my own household	1	2	3	4	5
E2	I would prefer to use wastewater from my own neighbourhood	1	2	3	4	5
E3	I would prefer to use wastewater from the whole city	1	2	3	4	5
E4	Please state other source of waste water you would prefer below	1	2	3	4	5
E5: Please state other source of waste water you would prefer:_____						
SECTION F: Type of water to be recycled						
F1	I would prefer to use rainwater tanks from my own roof to augment water supply	1	2	3	4	5
F2	I would prefer to use greywater (water from washing clothes, own body, dishes etc) to augment water supply	1	2	3	4	5
F3	I would prefer to use wastewater (from wastewater treatment plants) to augment water supply	1	2	3	4	5
F4	Other	1	2	3	4	5
F5: State other type of water you would prefer:_____						
SECTION G: State any comments you may have on wastewater reuse						
_____						

THANK YOU FOR YOUR PARTICIPATION!

ANNEXURE C: LANGUAGE EDITOR'S CERTIFICATE

Declaration

This is to declare that I, Annette L Combrink

Accredited language editor and translator of the

South African Translators' institute

have language edited the dissertation by

LELETHU BUNGU

with the title

ASSESSING THE PERCEPTIONS OF CONSUMERS IN THE VAAL TRIANGLE ON WASTEWATER REUSE

Prof. Annette L Combrink

Accredited translator and language editor,

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Date: 13 November 2014