ESTIMATION OF THE RESIDENTIAL PRICE ELASTICITY OF DEMAND FOR WATER BY MEANS OF A CONTINGENT VALUATION APPROACH

GA Veck • MR Bill

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Estimation of the residential Price Elasticity of Demand for Water by Means of a Contingent Valuation Approach

A Study Undertaken in Alberton and Thokoza

by

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THIS STUDY WAS UNDERTAKEN IN ALBERTON AND THOKOZA.

The Steering Committee responsible for this project, consisted of the following persons:

Dr GR Backeberg	Water Research Commission (Chairman)
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Mr CJ Williams	Economic Project Evaluation (Pty) Ltd

EXECUTIVE SUMMARY

1.1 Background to and Motivation for the Project

An important factor in being able to manage metered water effectively is knowledge of its price elasticity of demand. The need for estimating the price elasticity of demand for water in South Africa was emphasised by representatives of the World Bank during a meeting with the Department of Water Affairs and Forestry to discuss water tariffs during November 1996. So far as is known, no recent research effort has been undertaken into the subject in South Africa, however.

To correct that situation in 1997 a research project was initiated by the Water Research Commission (WRC) to address this problem. The report following this Executive Summary is the result of this initiative.

In studying the literature on determining the price elasticity of demand for water as a consequence of price increases, the researchers undertaking the WRC study found that econometric analysis was the common approach adopted. This approach requires a substantial database for exogenous and endogenous variables; such a database is not readily available to researchers in South Africa in an appropriate form at present. A study undertaken in Australia in 1987, however, approached the problem of estimating the price elasticity of demand for residential water using Contingent Valuation Methodology (CVM)[1].

Because of the data acquisition problems envisaged in undertaking the WRC study by means of an econometric analysis, it was decided to follow the Australian approach in the WRC study. This study therefore centres on the estimation of the residential price elasticities of demand for water for different income groups by means of CVM making it a unique initiative so far as South Africa is concerned.

[1] Thomas, JF & Syme, GJ: Estimating Residential price Elasticity of Demand for water; A Contingent Valuation Approach. Water Resource Research, vol. 24, No 11, 1988, pp 1847-1857.

1.2 Research Objective

The objective of this research study is to estimate the residential price elasticities of demand for water for different income groups by means of CVM. In this approach, research to determine the value of goods which are not bought or sold in the market, is undertaken by setting up a situation where respondents are asked in surveys how much of a non-market commodity, in this case water, they would buy as the price increased. Responses to this question are known as "Contingent Values", because they are values respondents perceive they will pay contingent upon a market being created. The literature shows that CV values are good surrogates for actual behaviour and that CV measures from surveys can be directly and validly compared with economic values attained from behaviours in the market place.

This study was undertaken in the residential areas of Alberton and Thokoza, 111 people were interviewed in Alberton and 50 in Thokoza, giving a total sample size of 161.

1.3 Methodological Approach to the Study

The methodological approach to this study was by means of a two-stage interview survey.

- Survey No 1: Consisted of establishing a water usage profile for different income groups in Alberton and Thokoza.
- Survey No 2: Consisted of a CV experiment and analysis.

The purpose of Survey No 1 was to establish detailed water use characteristics for the areas chosen. This information was necessary in order to be able to undertake the second survey.

The purpose of Survey No 2 was to provide data on consumer responses contingent upon price increases for water, so that the price elasticities of demand could be estimated. In spite of the difficulties expected with respect tp data acquisition, an econometric model was also designed for attempting to cross-check the values found.

1.4 Summary of Results of the Study

During these surveys, it was found that people were not aware of how they used water, nor were they aware of how they could save water. As a result, it was necessary to undertake an educational programme as part of the complete process in order to arrive at a meaningful result. Surveys 1 and 2 were therefore used in conjunction with each other, and the end result of the analysis yielded defensible estimates of the price elasticity of demand for domestic water usage amongst residential consumers in Alberton and Thokoza. The results obtained from the two surveys are summarised in Figure E.1 and Table E.1 below. From the results it can be seen that the price elasticity of demand for total water usage in Alberton and Thokoza is –0.17. It therefore follows that if the price of metered water for residential use is increased by 10%, the total water demand would be reduced by 1.7%.

Whilst the research objective of the study was successfully achieved, unfortunately (and as expected) due to insufficient quality historical data, the econometric model developed for comparison purposes for predicting the short-term price elsaticity of demand could not be exercised. An attempt was made, however, to use the econometric model for gauging the long-term price elasticity of demand for water. This was done so that the results could be compared with the only other study found by the researchers for determining the price elasticity of demand for water in South Africa which was that undertaken by JA Döckel[2]. In this study Döckel used a macro-econometric model to determine the long-term price elasticity of demand for residential water in an area that is now greater Gauteng, some 25 years ago. Döckel's research yielded a price elasticity of demand of –0.69 which compares favourably with the figure arrived at from the macro-econometric model used at Alberton which yielded a figure of –0.73.

[2] J.A. Döckel: The Influence of the Price of Water on Certain Water Demand Categories, Agrekon, volume 12, No. 3, July 1973.

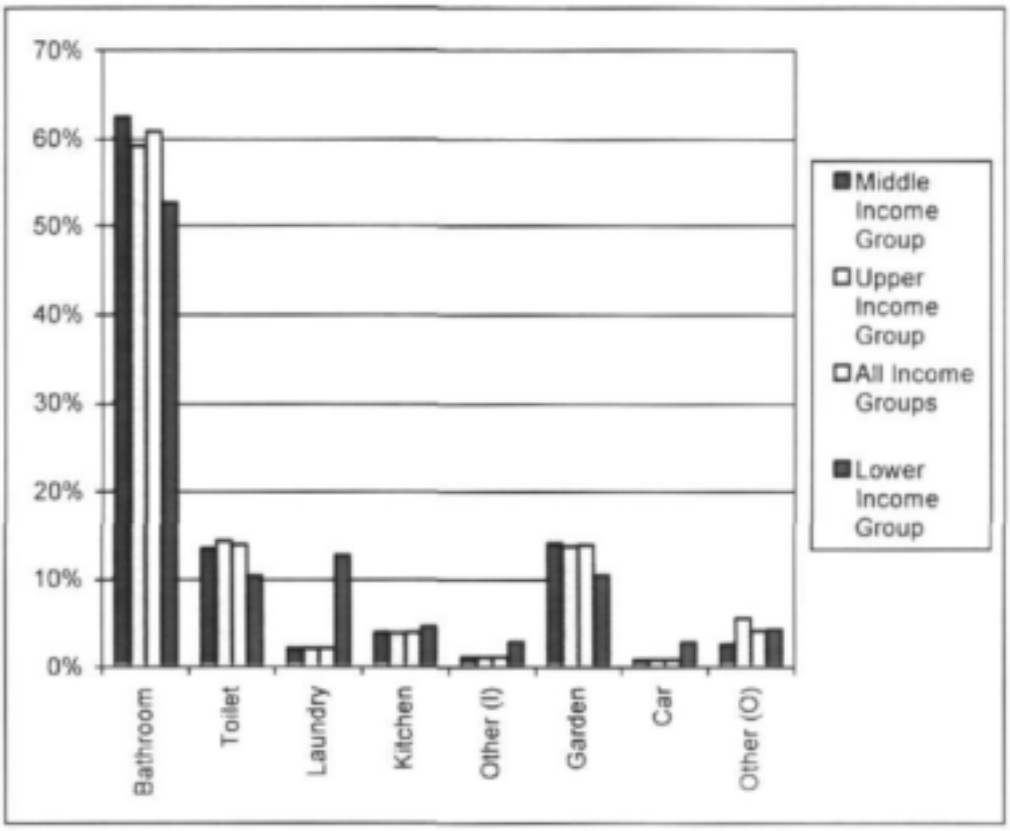

Figure E.1 Perceived Profile of Monthly Water Usage

Description of group	No. of Respond.	Price Elasticity of Demand		
		Indoors	Outdoors	Total
Upper, middle and lower income groups	161	-0.13	-0.38	-0.17
Upper income group	52	-0.14	-0.47	-0.19
Middle income group	59	-0.12	-0.46	-0.17
Lower income group	50	-0.14	-0.19	-0.14
Upper and middle income groups	111	-0.13	-0.47	-0.18

Table E.1 CV Results: Price Elasticity of Demand for Water

1.5 Conclusions Drawn from the Study

The CVM used in this study has been found to be a powerful approach for determining the price elasticity of demand for water. To demonstrate this, comparisons are now made between the results of the research carried out in this study and the results of international research undertaken to determine the price elasticity of demand for water. For ease of comparison the following two tables are used:

- Table E.2 below compares the price elasticity of demand for total water usage in the short-run in various international studies. All of these international studies, except for the last two in Table E.2, have used a macro-economic approach for determining the price elasticity of demand.

- Table E.3 below compares the short-run price elasticities of demand for indoor, outdoor and total water usage found in this study with the study carried out in Perth, Australia referred to above. These comparisons are of course particularly important since as noted already, both studies were carried out using CVM.

Researcher/s	Date	Location	Price Elasticity
Carver and Boland	1969	Washington D.C.	-0,1
Agthee and Billings	1974	Tucson, Arizona	-0,18
Martin et al	1976	Tucson, Arizona	-0,26
Hanke and de Mare	1971	Malmo, Sweden	-0,15
Gallagher et al	1972/3 & 1976/7	Toowoonba, Queensland	-0,26
Boistard	1985	France	-0,17
Thomas and Syme	1979	Perth, Australia	-0,18
Veck and Bill[3]	1998	Alberton & Thokoza, South Africa	-0,17

Table E.2 Comparison of Short-Run Price Elasticities for Total Water Usage[4]

Researchers	Date	Location	Price Elasticity		
			Indoor	Outdoor	Total
Thomas and Syme	1979	Perth, Australia	-0,04	-0,31	-0,18
Veck and Bill[3]	1998	Alberton & Thokoza, South Africa	-0,13	-0,38	-0,17

Table E.3 Comparison of Short-Run Price Elasticities for Indoor, Outdoor and Total Water Usage

[3] Of Economic Project Evaluation (Pty) Ltd (EPE)
[4] CV methods were undertaken by Thomas and Syme and Veck and Bill, the remaining studies used short-term macro-econometric methods.

It is important to emphasise that the figures quoted in the tables above are all short-run price elasticities of demand for water. It is clear that the results are very compatible in both tables. It will be observed from table E.2, in the international case studies, the price elasticities of demand for total water usage range from –0.1 to –0.26. The literature reports short-run average price elasticities of demand for several international studies to be –0.21 as against –0.17 found in this study. This gives considerable confidence in the figures obtained from this study.

Table E.3 offers a comparison between this study and the Australia study referred to above, i.e. comparing both the indoor, outdoor and total price elasticities of demand for water. The method of approach in these two studies is also directly comparable, as is the range of the price increase considered. In addition, different levels of income were also considered in both these studies. The price elasticity of demand for indoor water use in Perth is seen to be more inelastic compared to this study, whereas the outdoor elasticity is very comparable, i.e. –0.31 in Perth and –0.38 in Alberton/Thokoza. It is suggested that the large difference in the indoor price elasticity of demand for water between Perth and Alberton/Thokoza is as a result of a better understanding that water consumers in Perth have of the scarcity value of water. This understanding arising from an extensive educational initiative that was undertaken after the severe drought in Perth which occurred in the late 1970's prior to the Australian study being undertaken.

In comparing long-run price elasticities of demand with those in the short-run as determined in this study it is seen that in the long-run, the price elasticity of demand for water is more elastic than in the short-run. For example the average short-run price elasticity of demand for water is –0,21, whilst in the long-run, the average figure is –0.6. This difference is generally considered to be because consumers become more knowledgeable with regard to water management over time. Once consumers become

more knowledgeable they become more aware of the potential benefits of water conservation, efforts toward reducing consumption thus increase.

1.6 Use of the Study for Resource Planners and Policy Formulation

The results of this study can be of use to water resource planners and policy makers. For example the study has shown that the price of water is an important consideration so far as domestic consumption is concerned and therefore impacts demand side management. Demand side management helps in the conservation of water resources and in the improvement of the living environment by lowering volume and pollution loads of wastewater flows. Whilst the price elasticity of demand has been shown in this study to be inelastic in the short-term for all forms of domestic water usage, the price of water was nevertheless important, since it conditioned consumers' water usage behaviour. People of all income levels were shown to take cognisance of changes in the price of water and tended to reduce their water usage as the price of water increased. In quantitative terms, and as noted above, a 10% increase in the price of piped water for residential use in Alberton and Thokoza, the water demand would be reduced by 1.7%. Such information can be used in cost benefit analysis for determining when or when not to build new water supply investments, e.g. instead of building a new dam or reservoir at some specified early date, price increases can be put in place to delay such an investment which in turn may free financial resources for other development activities such as the improving of water services to the poor.

A legitimate question that can be asked with respect to this study is whether these results can be extrapolated and used by policy makers and water planners in other areas in South Africa with confidence? The answer to this question is that the results of this study can only reliably be used for other areas in South Africa provided the following conditions apply:

- A socio-economic profile similar to that of the study area must exist, i.e., educational level, income level, family size etc.

- The climatic conditions should also closely resemble the study area, i.e., precipitation and temperature, etc. and
- A culture similar to the study area should also exist.

The results obtained are also largely dependent on the implementation of an educational programme dealing with aspects of water usage, i.e. how water is used and knowledge of ways to save water. This then is relevant when attempting to extrapolate these results for other areas in South Africa, as the behaviour of people as the price of water increases, will depend largely on their knowledge of water conservation issues gained from an educational programme.

1.7 Final Comments

This study has shown that water pricing is one of the most important economic instruments that does work for controlling consumers demand for water. Knowledge of people's behaviour under increasing price regimes is therefore an important piece of information for those charged with water policy formulation and water resource planners. CVM has been shown in this study to provide this information in a relatively simple way. As a result of the experience gained in this study it is also suggested that a very important consideration when selecting policy instruments for conserving and managing water efficiently, is the need to act at three levels of intervention for achieving these objectives ; these are

- Firstly, national policies and strategies are needed at the macro-level, which set the basis within which the water supply and sanitation industry can operate;
- Secondly, a set of actions is required at the user's level. They can take two forms:
    (i) They may act as incentives for water users who can themselves determine the most efficient and cost-effective water usage patterns. Here Survey No. 1 in this study proved to be a useful guide to consumers for doing this; and

(ii) They can be direct regulations that prohibit or limit excessive use of water along with monitoring and enforcement systems, i.e. command and control instruments;

- Thirdly, a set of actions is needed at the utility's level which can act as incentives to affect provider's behaviour on the way they manage the resource. Such actions would of course have to take cognisance of the utilities' own financial health.

The levels of intervention are not alternatives, but instead they reinforce each other. What is needed is a balance of the three layers to create a critical mass and synergy.

1.8 Future Work

In view of the different socio-economic profiles as well as climatic conditions existing in South Africa, it would be of benefit to undertake similar studies to this one in other cities in the country. Use of the experience gained in Alberton and Thokoza should be made in formulating these studies. In this pilot study, undertaken by EPE and discussed in this report, three particular variables only were considered for estimating consumer response for water price increases, these being the impact of family income, indoor and outdoor water use and the water price itself[5]. It is recommended that in future studies, the variables mentioned above should be increased in number and considered in greater depth. The following list suggets additional variables that should be considered:

- Socio-economic variables of the household itself such as size, age of the members and ownership of the house.
- Characteristics of the residency such as population density, area of the lawn, availability of alternative water sources, age of the house, and water using fixtures;
- Climate conditions, e.g., temperature, precipitation and evapotranspiration rate;
- Water restrictions if any; and

[5] In addition, the respondents of the survey were involved in a partial education programme on how they use water and how water could be saved.

- Type of water service, as measured in number of taps, water pressure, reliability, and water quality.
- In order to successfully undertake similar studies i.e., to estimate the price elasticity of demand for water, in other cities of South Africa, a far wider educational and conservation programme that was undertaken in this study is also recommended. Educational and conservation programmes are used to create awareness of water use and to encourage consumers to change their water consuing habits. Several examples of such a programme have been undertaken in different parts of the world, e.g., Bogor Indonesia, Melbourne Australia and Tucson Arizona, cited in Yepes, Dianderas and Cestti (1995, pp. 45-46).

Expanding the number of variables analysed will provide policy makers and water resource planners with a greater understanding of the dynamics of domestic water usage and the factors that influence water users' behaviour under increasing price levels. This will allow policy formulation and water resource planning to be made with greater confidence in an ambiance of consumer participation.

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THE CONCEPT OF "PRICE" AS USED IN THIS REPORT

Water is a private good with great public Goodness attached to it and is supplied to the public in a direct exchange relationship. This relationship involves free contracting between the supplier of water, be it the government or water boards and the public as consumers (the buyers). Consumers buy water according to personal need and their ability to pay for it; they pay a "price" for it often referred to as a "consumer tariff". In this study the terms "price" and "consumer tariff" are taken to be synonymous and therefore interchangeable[1].

[1] *In the literature the terms "price" and "consumer tariff" are sometimes collectively known as user charges. This is technically incorrect, however, since there is a fundamental difference in the meaning of the terms user charges and consumer tariffs, cf., Gildenhuys (1997).*

The traditional approach used by water supply utilities in developing and industrialised countries, with respect to managing future water requirements, has in the past been based on projections of current water usage patterns and the use of existing prices to develop new water sources to satisfy those needs, i.e. water planners have favoured a supply side approach. (Yepes, Dianderas, Cestti, (1995)) This situation applies to South Africa. The major limitation of this approach is that it ignores the significance of the economic aspects of water demand. It is suggested that the efficient planning and management of water supply systems depend on a thorough understanding of the determinants of water demand as well as water supply.

Until now, little consideration has been given in South Africa to a more comprehensive approach that takes into account the number of factors that influence water demand, especially those which utilities can control, e.g., water pricing. Poor knowledge of water demand may lead to costly infrastructure investments that remain idle for a number of years[3].

An important factor in managing metered water efficiently from the demand side is knowledge of water's price elasticities of demand. This fact has been highlighted in a recently completed study by the Department of Water Affairs and Forestry concerning the future tariff structure of water in South Africa[4]. Furthermore, the need for an understanding of price elasticity of demand for water in South Africa was emphasised by representatives of the World Bank during a meeting with the Department of Water Affairs and Forestry in November 1996 to discuss water-pricing policy. So far as is known no serious recent research effort has been undertaken into determining price elasticities for water in South Africa, however.

The aim of this study is to correct that situation by determining the price elasticities of demand for indoor and outdoor metered water usage amongst urban households for

[3] Demand forecasting is a critical element during project preparation. In essence, it determines the timing, the size, the phasing, and the cost of a project, as well as the economic benefits derived from it, The World Bank (1992).
[4] Water Tariff Policy Review, Department of Water Affairs and Forestry, (1998).

CHAPTER 1 - BACKGROUND

1.1 Introduction

This Chapter is divided into five sections not including this introduction. The first section explains the rationale and aim of this study; the second section outlines the methodological approach to the study; the third section gives the background of the data availability; the fourth section briefly describes the sampling and the data collection methodology; and the last section provides an overview of the schema of this report.

1.2 The Rationale and Aim of the Study

Most of the developing world, including South Africa, is facing an increasing cost of urban water supply provision in both financial and environmental terms. This is because of the necessity of bringing water from ever-longer distances to urban centres; the need to build new dams and storage facilities; and the additional water treatment as water of a lower quality is used.

The water sector in most developing countries is also characterised by enormous waste in the use of water[1] and often unnecessary usage, e.g., in South Africa leakages and ineffective metering in townships lead to water waste[2]. There is also unnecessary usage from excess watering of gardens in affluent areas. There are several reasons for excess water usage e.g., low water prices which do not provide the right signals to the users about the scarcity value of the resource; water tariff structures which are not consistent with water conservation goals; inadequate cost recovery policies which lead to lack of funds for maintenance of systems; heavy and unhealthy dependency on central budgets and transfers, which often favour expanding water supply projects rather than rehabilitating them.

[1] Yepes, Dianderas and Cestti, (1995), page 5.

[2] An example with respect to water wastage from ineffective metering, is in Argentina, where the net consumption of unmetered cities is around 400 litres per capita per day, while the consumption of a metered city like Santiago de Chile in Chile, is only 240 litres per capita per day.

different income levels in Alberton and Thokoza by means of a Contingent Valuation approach.

Contingent Valuation Methodology (CVM), in social-psychological terms, is a measure of behavioural intention. In situations involving the buying of goods or services. Willingness to pay is used as an indicator of these intentions.

Thomas and Syme, who undertook a study in Australia in 1988[5], to determine the price elasticity of demand for water, stated that CVM may provide a superior approach to other techniques for determining social, technical and behavioural responses to changes in the price of water. In Chapter 2 an overview of some of the literature on CVM is given in which the method's strengths and weaknesses are briefly discussed.

1.3 Methodological Approach to the Study

Determining price elasticities of demand for water has in the past been dominated by econometric analysis. This approach, however, requires a substantial database for exogenous and endogenous variables; such a database is not readily available to researchers in South Africa in an appropriate form.

CVM was therefore chosen as the preferred methodology for determining the price elasticity of demand for water in Alberton and Thokoza. Following the approach taken by Thomas and Syme (1988), a two stage interviewing survey and a statistical analysis of the results of the surveys were undertaken in these two areas.

The purpose of Survey No. 1 was to establish detailed water use characteristics for the area chosen i.e., a water usage profile for each consumer was established. The survey included a diary record of all water using activities over a period of two weeks for Alberton and one week for Thokoza for each respondent in that survey for both outside and in-house water consumption, and the completion of a detailed questionnaire

[5] Thomas, JF & Syme, GJ: Estimating Residential price Elasticity of Demand for water; A Contingent Valuation Approach. Water Resource Research, vol. 24, No 11, 1988, pp 1847-1857.

establishing basic demographic and appliance ownership information and various household characteristics.

The purpose of Survey No. 2 was to provide data on consumer responses contingent upon changing water supply conditions. For example questions were posed which enabled the researchers to see how water-using behaviour varies with water tariff changes etc. Whenever possible two household members were asked to co-operate to produce household responses to CV questions. This enabled one respondent to act as an informed observer to ensure that consistency was maintained with respect to past behaviour recorded from Survey No 1.

Surveys 1 and 2 were therefore used in conjunction with each other and responses to both surveys were compared to test the reliability of the responses given. The end result of the analysis yielded defensible estimates of the price elasticity of demand for surface water usage amongst residential consumers.

Survey No. 2 took place 3 months after Survey No. 1.

A pre-survey trial of the questionnaires for both surveys were undertaken to test the validity of the experiment and allow adjustment to be made if necessary thus ensuring that the surveys could be undertaken with confidence once the project had properly commenced.

In an attempt to check the results of the CVM a multi-regression econometric model was also developed. Because of the problems with respect to data mentioned above this attempt was largely unsuccessful. The results of these efforts are, however, recorded in Chapter 6.

1.4 Data Availability

This research has found that historical data for Alberton and Thokoza was not sufficient to support a serious study on price elasticities of demand by means of an econometric model. Although it was felt that data currently available was inadequate for a

comprehensive econometric analysis, it was nevertheless felt desirable to implement a simplified econometric model in parallel with the CV exercise in order to provide some results for comparison purposes.

With respect to data collection for the CVM there were initially problems (the reasons for these are given in Chapter 3), these were overcome, however, and sufficient data was obtained to complete the project.

1.5 Sampling and Data Collection Methodology

A sampling strategy for both surveys was developed that assured sufficiently large and representative samples, which supported statistical inferences about the population of the study area. Personal interviews were used in the surveys. Whilst telephone and mail surveys could have been used, personal interviewing was considered to be the most versatile of these methods. The personal interviewer could ask more questions and could supplement the interview with personal observations. Personal interviewing was, however, the most costly and required the greatest amount of technical and administrative planning and supervision; 150 households were surveyed.

The overall goal of the sampling effort was to achieve a "high" response rate of usable evidence. A public participation effort (by means of a description of the study and the reasons for undertaking it, which was included in the Alberton Municipality monthly newsletter) was undertaken prior to the commencement of the research to gain the good will and co-operation of the participants. Meetings were held with the researchers responsible for undertaking the surveys to ensure that data was being carefully and accurately encoded for analysis.

1.6 Schema of the Report.

This report is divided into seven chapters including this chapter. Chapter 2 provides a literature overview. Chapter 3 describes the physical and socio-economic profiles of

Alberton. Chapters 4 and 5 present and discuss the Water Usage Profile Survey (Survey No. 1) and the Contingent Valuation Survey (Survey No. 2) respectively. In Chapter 6, the econometric model is described, and Chapter 7 provides a summary of the objectives, results and conclusions of the study and recommendations for future work are suggested. A list of the selected references is provided, and in addition, the following Appendices are included:

- Appendix A: Maps of the area surveyed.
- Appendix B: The questionnaires for the Water Usage Profile Survey.
- Appendix C: Examples of the results of the Water Usage Profile Survey.
- Appendix D: The Water Usage Profile Survey database.
- Appendix E: The questionnaire for the CV Survey.
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CHAPTER 2 - LITERATURE OVERVIEW

2.1 Introduction

This chapter provides a brief overview of some of the literature on Contingent Valuation Methodology (CVM) for valuing non-market goods such as water. Firstly the chapter will consider CVM in general terms it then concentrates on CVM as applied to water and finally considers the estimation of the price elasticity of demand for water using CVM.

2.2 CVM General Discussion

The CV approach is used to estimate values for environmental amenities and non-market goods, by means of surveys. It was first suggested by Ciriancy-Wantrup in 1952. In 1963 Davis applied the method to measuring the recreational value of woodlands in the state of Maine in the USA. In 1974 Randall Ives and Eastman established the structure of the contingent market and suggested an iterative bidding process for revaluing the preference of individuals for non-market goods. To deal with operational questions that arose in conducting studies applications of CV experiments were greatly extended in the following years and the social-psychological aspects of CV experiments were researched.

With respect to the social-psychological nexus, contingent values have been defined by Herberlein and Bishop (1986) in social psychological terms as a measure of behavioural intention designated as (BI), or what people say they will do on surveys. Market values on the other hand, are obtained through observable buying and selling behaviour designated as (B). Now in this regard there exists in social psychology a considerable debate about the relationship between intention and behaviour. The relationship between (BI) and (B) was explained in three separate experiments and described in Herberlein and Bishop's paper.

This paper pointed out that a method of research often used by economists to determine the values of goods which are not bought or sold in a market, is usually undertaken by setting up a market where respondents are asked in surveys how much they would pay for

a commodity e.g.; water. Conversely surveys indicating how much a respondent would accept in return for a good of lesser quality are also sometimes undertaken e.g.; water which is slightly coloured or has an odour attached but is otherwise perfectly usable.

Responses to such questions are known as "Contingent Values" (CV) because they are values that respondents say they will pay, or receive, contingent upon a market being created. Herberlein and Bishop (1986) assert that CV is a real step forward in measuring non-market values and integrating these non market values into the decision making process. Their paper also examines whether the values people give in response to a survey are really what they would pay or accept in a real market. Their conclusion was that responses would truly represent such values. This paper then addresses the most fundamental question upon which CV studies are based.

Also with respect to the debate between (BI) and (B), Fishbein (1967) argues that in some cases "the correlation between measures of behavioural intention and the actual overt behaviour is almost perfect". High correlation between behavioural intention and behaviour has been found; for example r^2 =0,89, Ajzen & Fishbein, (1970), and r^2=0,82, Ajzen, (1971). According to these researchers "accurate behavioural prediction is possible where appropriate measures of behavioural intentions are obtained".

From these studies it can be concluded that CV values are good surrogates for actual behaviour and that CV measures from surveys can be directly and validly compared with economic values attained from behaviours in the market place. It is important to note, however, that these high correlations between behavioural intentions and behaviour were obtained in controlled situations where subjects had only two choices and were asked, after engaging in behaviours for a number of trials, how they intended to behave in the next series of trials. Interviewees may, however, be constrained in real life to behave in a way they would not when tested in a laboratory. In real life it may not be possible for an individual to carry out his intentions because of interpersonal or other constraints.

Psychologists concerned with actual behaviour have, however, demonstrated in certain literature their scepticism with (BI)-(B) correlations, e.g.; Schuman & Johnson (1976) argue that "a measured attitude is not a substitute for behaviour". So far as this view is concerned La Piere's work (1934) cited in Herbelein and Bishop (1986), is perhaps the seminal and most widely quoted investigation into (BI)-(B) relationships[1]. La Piere took his results to mean that observed behaviour in this particular market transaction was dramatically different from the behavioural intention of hotel owners.

What results from these different studies and opinions is that "the empirical relationship between intention and behaviour cannot be taken for granted but must be submitted to systematic empirical investigation". Herbelein & Bishop (1986) attempted to do just this in three field experiments they undertook in Wisconsin in the USA.

The experiments concerned hunting permits for Canada Geese and deer and gauged respondents behavioural intentions and actual behaviours for selling permits and behavioural intentions and actual behaviours for buying permits under dichotomous choice and sealed bid auction procedures[2].

So far as selling behaviour was concerned, contingent values produced statistically significant variations between intention and actual behaviour; e.g.; in the case of the Goose permit Dichotomous Choice the behavioural intention was 60% higher than actual behaviour, whilst the sealed bid auction for deer permits was 30% lower, indicating that the situation was reversed.

With respect to buying behavior, however, intention proved to be much closer to actual behaviour, e.g.; behaviour under sealed bid auction for deer permits was within 25% of behavioural intention, i.e.; 32 US dollars against 24. In the dichotomous choice

[1] This study was conducted during the depression years of 1930-1932 and concerned hotel proprietors' willingness to accept as guests certain racial groups. Whilst it was widely intimated by hotel management that they would not accept certain minority race groups when confronted with such guests that looked as though they would pay they almost always accepted them.

[2] Dichotomous Choice procedures occur when a simple yes or no is the answer to a specific offer. Auctions, as the name suggests, occurred when respondents sell or buy permits. So far as auction sales were concerned, respondents were offered various amounts for permits. The experiments were conducted hypothetically and in reality, and the results compared.

experiment the figure was even closer at 19%, i.e.; 31 US dollars against 25. The researchers concluded that values based upon behavioural intention measures of willingness-to -pay are only slightly inflated from values obtained using actual market behaviours. Willingness-to-sell values appeared to be highly inflated, however.

It was concluded by the researchers that the validity of willingness-to-pay measures fits well with social psychological theory because consumers have thousands of repeated experiences buying things, they therefore develop relatively clear ideas of what they would be willing to pay for commodities.

People, however, sell things less frequently, they therefore have in contrast less experience so far as selling items are concerned. This anyway was the way the researchers explained the different results they obtained. Herbelein & Bishop (1986) claim that the results of their experiments "show some guarded optimism for the utility of willingness-to-pay contingent valuation for some kinds of non-market goods".

Cummings, Brookeshire and Schultze (1986) have observed that "the framing of questions in the process of developing the contingent market without influencing individual's responses can hinder the effectiveness of the contingent valuation method". The framing of questions is therefore important but particularly so when uncertainty is involved.

Uncertainty is an important issue so far as CV experiments are concerned and major federal and state policies in the USA have made it necessary to focus attention on measuring the value of non-market goods under uncertainty.

Differences in sample selection criteria also complicate the analysis and interpretation of the results of a CV experiment. According to Randal, Hoehn and Tolley (1981), estimates from CV experiments may also be affected by the procedures used to determine the final sample used for analysis.

Also with regard to sampling, the literature recommends that once the population for the study has been defined a sampling strategy must be developed that will ensure a sufficiently large and representative sample to support statistical inferences drawn from the study population. In the study described in this report the central limit theorem was taken cognisance of so far as sample size was concerned for each income group surveyed.

The literature is also extensive on which method of sampling should be undertaken in a CV study. Several methods of sampling are mentioned, the most popular being personal interviews, telephone interviews and mail surveys. Careful consideration is recommended so far as which type should be undertaken in the context of the specific study, see Mitchell and Carson, (1989) and Dillman, (1978).

Whilst many studies have been conducted some of which have been designed to further develop CV experiments, it is clear from the literature that CV continues to be a subject of debate. This is principally because preferences revealed through actual behaviour have great credibility in economics and statements by economic actors about how they would behave under hypothetical circumstances still continue to be viewed with some suspicion.

As a consequence the scientific issue so far as CV experiments are concerned is one of "validity"[3]. Hence for CV to be successful it is essential that respondents be both willing and able to reveal how much they would pay or demand. One of the major problems with this, however, is that respondents very often have never been asked to express such preferences. They are then inexperienced in this endeavour. Many economists therefore voice their reservations about the values obtained from CV experiments. Because CV has a psychological dimension it is generally agreed in the literature that it is a difficult thing for an individual to buy or sell a commodity by means of a survey using a hypothetical situation.

[3] Validity of a measure is the degree to which it measures the theoretical construct under investigation. The problem here is that normally the measure of the construct is unobservable. Hence all that can be done is to imperfectly measure the contrast, Mitchel & Carson, (1989).

Many researchers have examined the essentials for a framework to assess the validity of CV techniques; for example Mitchell and Carson (1989) and Sunberg (1978), point out that there are three types of validity, content validity, construct validity and criterion validity[4]. The validity criterion is important from the psychological aspects of CV since psychologists are always interested in the "validity" of their measures at the level of the individual subject. It is suggested that economists have a greater scope for random errors in measurement than do psychologists.

Whilst CV is not the only technique available to economists to quantify non-market goods in monetary terms, it is probably the most versatile approach especially when compared with such techniques as Travel Cost, which is usually used for measuring recreational use values, and Hedonic Pricing, which is limited to use values as reflected in real estate, wage or other markets. In contrast CV can be applied to a very wide range of resource use values and is able to capture the full non-use values associated with such goods as natural resources.

It can be argued then that CVM is a useful tool for measuring a wide range of non-market values. This view was supported by a distinguished panel of experts (chaired by Nobel Laureates in economics Kenneth Arrow and Robert Salow) that was organised by the National Oceanic and Atmosphere Administration (NOAA) of the US Department of Commerce. NOAA promulgates rules for assessing the damages from such things as oil spills and other toxins so far as litigation is concerned in US waters.

The panel's response was positive and they were not persuaded by the arguments of those who felt that there was no useful information content in CV results in dealing with such problems because of the difficulties found in the past with CV studies. The panel

[4] A measurement instrument has content validity if it accurately measures the aspects of the theoretical construct that is to be quantified. In CV this means evaluating the content of the survey instrument and related materials, e.g.; visual aids etc. Construct validity deals with the degree to which the measure under scrutiny is related to other measures as predicted by theory, e.g; in the case of the Alberton study comparing the price elasticity of demand found by means of the survey with that found from an econometric model. Criterion validity is defined by Sunberg (1978) as "the relation of the [psychological] test to criteria outside the test itself. Actual market prices would be ideal measures to use of course in assessing the criterion validity of CV. Unfortunately there are many goods where market prices do not as a rule exist.

subsequently put forward guidelines for CV applications (see US Department of Commerce Publication 1993). The panel's conclusions said, "CV studies convey useful information. We think it fair to describe such information as reliable by the standards that seem to be implicit in similar contexts, like market analysis for new innovative products and the assessment of other damages normally allowed in court proceedings". Finally the panel captured three essential points about the current state of the art so far as CV is concerned, these being:

(i) There is too much evidence to the contrary to warrant dismissal of the method, CVM is capable of providing useful, if possibly imperfect, information about values;

(ii) CVM studies do not automatically provide such information, however. To be taken seriously a CVM study must therefore have a high degree of content validity at the outset, and evidence supporting construct and criterion validity should also be in evidence;

(iii) More research to learn how to enhance the validity of CVM applications is badly needed.

In linking CV to classical economic theory Hoehn & Randall (1987) consider that "CVM denotes a set of procedures used to generate through direct questioning, estimates of the Hicksian measures of welfare change". Initial linkages to standard economic theory have been explored also by Brookshire and Coursey (1987).

The consistency of CVM results are also demonstrated in the literature, e.g.; Hoehn & Randall (1987) mention that "several types of evidence tend to corroborate the reliability of CVM results". Tolley (1984) assert that CVM results were consistent with revealed preferences by actual choice behaviour. Their research also allowed them to state that CVM results are consistent with valuations estimated via other methods of approaching valuation problems. Knetch & Davis (1966) also share this view.

While the supportive evidence is substantial the literature points out that several anomalies do occur in empirical work. Their observations have been touched on already in this discussion but it is perhaps just as well to reassert that large valuations often occur in Willingness-to-Accept (WTA) compensation cases and also in Willingness-to-Pay (WTP) for non-market goods cases. The dilemma is that in the absence of robust explanatory theories these anomalies can cast doubt on the accuracy of CVM. Explanations have been put forward for such anomalies, however. Samuleson (1954) for example put forward the idea of "false signals" and suggests that such signals obviates respondents answering CV questions on valuation accurately. These "false signals" can emanate from badly constructed CV questionnaires therefore, as mentioned already, great care must necessarily by taken with the design of such questionnaires. Furthermore field researchers should be well trained in soliciting answers to questions concerning WTP and WTA.

It has also been argued in the literature on CVM that the hypothetical aspect of the technique induces respondents to reply to questions in a careless manner regarding WTP and WTA; researchers should therefore have checking procedures built into the questioning process so that careless answers can be obviated. It is also possible of course that "free rider" behaviour can cause divergence between hypothetical and actual responses in CV studies. Because of these anomalies it is not surprising that disagreements concerning the reliability of the CV approach to problems of valuing non-market goods and services sometimes arise, and possibly always will. The general objective of Hoehn & Randall's paper (1987) is therefore to suggest "that CVM is a progressive research programme" i.e.; it is a "progressing programme rather than a degenerating" one.

Hoehn & Randall (1987) conclude with the assertion that "the possibility of constructing satisfactory benefit cost indicators from CVM data has been established whilst not all CVM exercises are equally effective the differences among them may be attributable to fundamental design features as well as to the care and attention paid to research

procedures". Their analysis also suggested ways of improving the credibility of CVM and more insightful interpretations of the results of CVM experiments.

2.3 CVM and Water

An important consideration so far as this study is concerned in assessing the validity of CVM, is reviewing the progress researchers have made in making CV a more acceptable approach for valuing water. Clearly the need for establishing a value base for water is very real, without such values cost-benefit analysis, a major tool in the arsenal of applied economics is rendered suspect. In attempting to pass opinion on public policy matters economics cannot therefore limit itself to goods and services that are allocated via the market mechanism but have to consider non-market goods and services as well.

This is particularly true when the question of human welfare is being debated; and water resources are very important with respect to this. CV is therefore gaining acceptance as a bona fide approach to the problems of water and human welfare and this is clearly shown in the literature on the subject.

Various researchers have for example used CVM for estimating the benefits of improved water quality and in stream flow requirements for water recreation see Gramilch (1977), Daubert and Young (1981), and Greenley, Walsh and Young (1982)).

Two specific examples of CVM applied to water projects will be very briefly commented upon here. These projects are concerned with the Monongahela River in the USA and the Keelung River in Taiwan.

2.3.1 The Monongahela River

Desvousges, Smith and Fisher (1987) estimated the option price bids for the improved recreation resulting from enhanced water quality in the Pennsylvania portion of the Monongahela River by means of a contingent valuation experiment. The findings are based on a survey design that used professional interviewers to conduct personal interviews determined from a representative sample of 393 households. In this study the

option price was the maximum annual payment that an individual was willing to make for access to the Monongahela River with improved water quality. The authors point out that in trying to determine this by means of a CV experiment the importance of how questions were framed and asked in the CV experiment was paramount. In the case of the option price for the Monongahela River project the sensitivity of respondents' income levels was crucial in preparing the questionnaire. The authors discussed in some detail characteristics of protest bidders and the identification of outliers. Careful sample selection should therefore be used to eliminate protest bids and outlying bids. Desvouges, Smith and Fisher (1987) assert that from their work on the Monongahela River project a sample should be selected on the basis of a common objective to detect individuals who fall into one or more of three categories, these being:

(i) Respondents who reject the framing of the contingent commodity;

(ii) Respondents who fail to take the valuation exercise seriously, and

(iii) Respondents who misunderstand or are incapable of processing the information required to participate effectively in the CV experiment.

Screening such respondents out of a CV experiment is required to exclude responses that would lead to biased estimates.

In the Monongahela study the overall prognosis of the CV experiment was positive. The empirical models performed well in explaining variations in option price with little indication that individual field researchers influenced the results. Respondents also did perceive the experiment as a reflection of reality and had no problem with the fact that it was a hypothetical experiment, (this finding augured well for the Alberton study).

All in all authors findings "support using contingent valuation surveys to measure option prices for improved water quality" and further that "the prognosis for the Monongahala river case study for the continued use of the contingent valuation approach is positive".

Furthermore these results confirm state-of-the-art assessments of CV experiments by Cummings, Brookshire and Schulze (1986) and Randal, Hoehn and Tolley (1981).

2.3.2 The Keelung River

Another study undertaken by means of a CV experiment on estimating the economic benefits of water quality improvements was researched by Hsu and Li (1990). This study also attempted to identify the factors that cause differences in willingness-to-pay for water quality improvements observed amongst water consumers. The survey took place in Taiwan and concerned the Keelung River. The Keelung River is one of the most polluted rivers in Taiwan and passes through the most populated area of the country. 250 responses were obtained but only 186 of these were eventually found to be valid and were used in the analysis. The concern underpinning this study was the deterioration of the natural environment in Taiwan over the years from about 1960. Environmental protection in Taiwan has become an ever increasing concern to the public and has received wide spread attention over the last 30 years and the link between economic development and environmental protection has been subject to much controversy. The authors also mention the limitations of the Travel Cost method in estimating environmental benefits. Based on their work on the Keelung River study Hsu and Li are of the opinion that CV has proved itself as an effective tool in valuing water quality.

2.3.3 Related Studies

A related study (which was not a CV experiment) is also examined here since it gives a perception of "The Ways People Think About Water" (the title of the paper written about the study by Nancarrow, Smith & Syme, 1996). The paper can be related to CVM because of the psychological content in CV experiments. The paper showed that, despite the significance of water in every facet of human existence, there is little information available about how people think about water in varying contexts, e.g.; water rights, its environmental significance and water usage in domestic situations. The objective of the authors was to determine if there were identifiable sub-groups of ways people thought

about water. They were anxious to determine whether how people thought about water would condition their responses to water price increases, and if this was so whether a consumer's viewpoint could effect what he or she would be prepared to pay for water for different uses. This information would be an aid in CV questionnaire development. Surprisingly the researchers found that their results suggested that the ways people think about water does not predict their water consumption.

This result raises an interesting question, are people more concerned with their own welfare than global issues concerning water? If this is so, whilst they may realise how scarce water may be in South Africa, so long as the price is reasonably low (a small portion of their income) no effort at conservation will come about. If the results of the above mentioned study really are correct it would suggest that an educational programme concerning the importance of water should be put in place. Of more importance to CVM, however, is whether water consumers can be relied upon to give accurate responses to CV questions. CV experiments must then be conducted with great care and this assertion supports the two-stage approach used in the Alberton study, which is described below, since by this means consumers can be questioned in depth about their water usage patterns.

Another similar, but earlier study, by Syme, Thomas & Salerian (1983) entitled "Can Household Attitudes Predict Water Consumption" investigated the potential for attitudinal and behavioural variables to account for household water usage in Perth, Western Australia. In this study 491 multiple person households living in detached houses without bore-holes formed the sample investigated. Both husband and wife were interviewed to measure income, time spent on gardening, the value of the garden as a recreational facility, attitudes towards price and perceived water quality. Univariate and multivariate statistical comparisons between low, medium and high water consuming households were made. From the study the researchers concluded that consumer's behaviour in relation to

water consumption was best understood if water's contribution to overall lifestyles, rather than water per se, was made.

This conclusion essentially means that social and attitudinal data are likely to provide a valuable component to more traditional data, such as physical and economic variables, in accounting for variations in water consumption between different people. Such data can readily be gathered in CV surveys. In the Alberton study for example an attempt was made to address this point in the CV questionnaire when questions re water used for gardening activities were formulated. The Thomas and Syme study already referred to in Chapter 1, also suggests that the two-stage approach to gathering data has something to recommend it since having determined a robust usage profile each respondent would find it more difficult to produce biased answers, or answers which were arbitrarily arrived at in the second stage of the study.

These two related studies gave valuable guidance to the researchers in the Alberton and Thokoza study with regard to the formulation of questionnaires and how to go about the study itself.

2.4 CV and Estimating the Price Elasticity of Demand

Only one study could be found in the literature that estimated the price elasticity of demand by means of a Contingent Valuation experiment, i.e. the Thomas and Syme study referred to above. The researchers in this study concluded that whilst there was little doubt that many factors had a part to play in explaining water usage trends Thomas and Syme assert that the separate effects of each factor, including changes in the price of water could not satisfactorily be estimated by regression analysis. This hypothesis led to the researchers developing a CV experiment to estimate the price elasticity of water in the Perth area. They believed that the CV approach provided a superior method of determining social, technical and behavioural responses to changes in the price of water since difficulties with co-linearity and nonstationary changes in price structure would

render an econometric solution to the problem rather suspect. This section briefly describes the Thomas and Syme study.

The Perth Metropolitan Area has a population of about one million; the area enjoys a Mediterranean climate and is situated on a sandy coastal plain. Residential density is low and some 78 percent of the population live in detached dwellings. Because of a drought in the late 70's, water restrictions were imposed. Consumers were encouraged on television and in the press to reduce water use. A two-part tariff was introduced which replaced the previous system of water entitlements according to property valuation. Water consumption fell as a consequence from around 500 kilo-litres per household in 1975-76 to around 300 kilo-litres in 1981-82. In 1981 the Perth Metropolitan Water Authority decided to undertake a study to estimate, amongst other things, the current price elasticity of residential demand for public water by means of an econometric analysis. A number of factors cast doubt on the results and this lead to the development of a CV approach being used by Thomas and Syme to re-examine the price elasticity of demand estimate. The CV approach involved a two-stage interviewing regimen with household members. The first stage consisted of a preliminary survey of water use. The second stage comprised the CV experiment.

The sample of 3640 dwellings was taken in 26 fortnightly groups of 140 dwellings during 1981-82. The first stage survey produced estimates of daily water use by component use, the component being the kitchen, bathrooms, toilet, laundry, garden and other outside usage..

The CV experiment was successfully administered in October-December 1982 to 312 households with three different income levels used selected at random from the first stage survey. In the CV experiment great care was paid to interview design. Pre-tests of the questionnaire were undertaken. Interviewers were graduates with experience in several surveys recruited mainly from psychology departments of tertiary institutions. A ten-day interviewer-training course was conducted. The questionnaire was designed as a consumer

advisory service in which household members reviewed their water use, likely changes in household for the coming year were considered and likely bill amounts were likewise considered. These likely responses to hypothetical changes in water price were solicited. When responses contingent on hypothetical price changes (28c, 41c and 62c per kl) were elicited questions were asked about the technical and behavioural changes, which the household would undertake to achieve a desired change in water consumption as the price of water increased. A discussion on these changes were undertaken so that they could be practically achieved and interviewees were equipped with a manual giving proportions of in-house and outdoor water use which could be achieved by the nominated method.

Interviewers always accepted the householders' estimates in the event of a dispute of how such savings could be achieved, this event occurred rarely, however. Ordinary least squares regression was used to develop the demand function for the different income groups.

The Perth study used as a guide for the Alberton/Thokoza study; the approach used by Thomas and Syme in Perth was adopted at Alberton and Thokoza and the observations of the researchers in the related studies discussed under section 2.3.3 above were taken into account as well. In addition due regard was given to important issues identified in the other literature surveyed in this chapter. For example the work of Herbelein and Bishop (1986) on willingness-to-pay estimates by CVM provided encouragement and confidence that CVM could be used in Alberton and Thokoza for gauging willingness-to-pay for water. With respect to validity criteria, attention was paid in the Alberton study, e.g.; so far as content validity was concerned visual aids were used to denote water usage patterns, i.e.; buckets, time to water lawns etc. Construct validity was dealt with by means of an econometric model (which is discussed in Chapter 6 of this report) and criterion validity was addressed by gauging willingness-to-pay in simulated markets, i.e.; by increasing the price of water in discrete blocks. Furthermore in designing the CV scenarios at Alberton and Thokoza with content validity in mind and using the suggestion for a "focus group",

see Fischoff and Furby, (1988), such a group was established for testing people's view of the survey questionnaire layout and to test whether it was clearly understandable or not. The group was asked specifically to evaluate the adequacy of the verbal descriptions given and the written material comprising the survey.

Careful attention was also paid to ensure that protest and outlying bids were removed from the sample of people interviewed in Alberton and Thokoza as suggested by Desvousges, Smith and Fisher (1987) and with respect to interviewing techniques face-to-face interviews were considered the best way of undertaking the Alberton and Thokoza surveys. Face-to-face interviews allowed the field researchers to identify the respondents that fell into the three categories of people that may give protest or outlying bids.

Personal interviews were also used because it was believed (and subsequently proven) that most people do not have a clear view of how much water they use or the value of water. Hence it was considered that it was important to clearly explain what each change in water usage meant in terms of cost and also the benefits received; e.g.; utility of washing a car over that of watering a lawn.

With respect to the difficulties found by Thomas and Syme with macro-econometric modelling of price elasticities of demand, these problems exist also in the Alberton study, as will be shown in Chapter 6, and in addition a suitable database, which is a prerequisite for successfully modelling the econometric approach to estimating the price elasticity of demand for water is, so far as can be determined, not readily available in South Africa at present. Hence the approach used by the Australians was a very attractive one for use on the Alberton study.

2.5 Conclusion

This chapter has tried to give, albeit briefly, an overview of some of the vast amount of literature available on CVM, which has a bearing on the Alberton study. To attempt a complete survey of the literature would constitute a major study in itself. In conclusion it

would be wise to step back from the debate surrounding whether CV experiments are acceptable or not in estimating the value of water and to concentrate on what has been accomplished by using the technique. In this respect it can be argued from an examination of the literature on the subject that CV reveals that those who have set out to develop CVM and test it's validity have made considerable progress in creating a tool that is useful for measuring non-market values. CVM has found ready acceptance by such agencies as the US Army Corps of Engineers, the US Fish and Wildlife Service and the US Environmental Protection Agency. In order for CVM to yield valid economic values, the literature is clear that study participants must be both willing and able to reveal their values. This means that a random sample of participants may sometimes have to be rejected since some participants may be for strategic reasons unwilling to reveal values. This happened in the Alberton study (see Chapter 4).

Many other CV experiments have been undertaken from the early days of Ciriancy-Wantrup and now CV experiments have acquired well-developed operational methodologies for the design of questionnaires and sampling surveys. In addition the US Environmental Protection Agency, in its Guidelines for Performing Regulatory Impact Analysis, published in 1983 listed CVM as one of four methods for valuing the environmental benefits of proposed regulation. In summary hundreds of CV studies have been carried out to measure willingness-to-pay for non-market goods such as water and it is this that gives the researchers undertaking the Alberton project encouragement to use this technique in attempting to estimate various price elasticities of demand for water in Alberton and Thokoza.

CHAPTER 3 - PHYSICAL AND SOCIO-ECONOMIC PROFILE OF ALBERTON

3.1 Introduction

This Chapter is divided into six sections in addition to this introduction. The first section provides an overview of the development and business environment of Alberton; the second section gives a physical profile of the area; the third section gives an overview of the population and income distribution in Alberton; the fourth section gives the gross operating budget for Alberton; the fifth section provides an overview of water users in Alberton, and the last section gives reasons for choosing Alberton for the research project to estimate the price elasticity of demand for water.

3.2 Development and Business Environment

Alberton was established in the early part of the 20th century and became a municipality in 1939. It is now an important manufacturing and residential centre. The magisterial district of Alberton comprises the main part of Alberton municipality, a portion of Germiston, a portion of Johannesburg and the black townships of Katlehong and Thokoza. (see Appendix A, Figure A1: Locality Plan).

The economy of the district is based predominantly on manufacturing, which accounts for 56% of the Gross Geographic Product (GGP) see Table 3.1 below. As can be seen from the Table, commerce, construction, finance and general government are also of some importance, accounting for 14%, 10%, 9% and 5% respectively. Alberton's economic growth rate has been greater than that of South Africa itself, with peaks occurring during the periods 1982/84 and 1986/87.

Year	Total GGP R-million	Agriculture & Forestry	Mining & Quarrying	Manufacturing	Electricity, Gas & Water	Construction	Commerce, Catering & Accommodation	Transport, Storage & Communication	Finance, Real Estate & Business	Community Social & Personal Services	Less Imputed Financial Services	General Government	Other Products
1991	484	0.1	0	56.9	1.0	9.9	14.3	3.7	8.9	0.8	1.7	4.6	1.8
1984	710	0.1	0	58.6	1.1	4.2	13.7	2.1	9.7	1.1	1.7	9.1	1.9

Table 3.1 Gross Geographic Product in Rmillions
Source: Greater Alberton Plan Data 1997.

The Central Business District (CBD) of Alberton was originally sited next to the railway station, but subsequently developed in the New Redruth area. In recent years the CBD area has undergone some major changes which were needed to modernise it. Included in these were the pedestrianisation of part of the main street (Voortrekker Street) and the new Civic Centre, as well as the building of several new shopping centres. There has been a significant increase in the number of commercial plans passed in recent years; new projects that have been implemented are:

- Group Five Properties additions to the Dion Centre, a major shopping complex.
- The multimillion rand new lake development by the Alberton Town Council which includes entertainment and recreational facilities as well as shops and offices.
- A new development by Standard Bank of SA.
- New offices developed by J. Sherman in New Redruth.

Industrial developments are centred in Alrode and Alrode South, which are located on the eastern edge of Alberton adjoining the Black towns of Katlehong and Thokoza.

Alrode is one of the oldest and largest industrial townships in the Johannesburg area and contains many large manufacturing enterprises including Wispeco, Uniwa, AECI Paints and SA Breweries.

3.3 Physical Profile of the Survey Area

The survey area covers the municipality of Alberton and the Thokoza township (see Appendix A: Maps of Area Surveyed). Details of the area are as follows:

- Size

Alberton Magisterial District:	146 km^2
Alberton / Edenpark area:	82.5 km^2
Thokoza area:	14 km^2
Urban area:	8 500 ha

- Distances

Alberton – north to south:	16 km
Alberton – east to west:	average 6 km
Distance from Alberton to the central area of Johannesburg:	18km

- Altitude above sea level

Average altitude:	1 580 MSL
Highest area:	1 800 MSL
Lowest area:	1 515 MSL

- Climate

Highveld climate:	Warm summers and cold dry winters
Annual precipitation:	700mm – 800 mm

3.4 Population Distribution[1] and Monthly Income in Greater Alberton

Table 3.2 below gives an overview of the population distribution in the various suburbs of the study area for the three income levels differentiated for purposes of this study.

	Township	Family Size	1991 CSS	1997 Estimate
High Income Level	Alberante	3 .7	1 347	1 088
	Brackendowns	3.0	13 278	15 834
	Brackenhurst	4.1	13 228	14 006
	Meyersdal	3.5	0	4 963
	Randhart	3.5	4 556	6 392
	TOTAL		32 409	42 283
Middle Income Level	Alberton North	4.1	4 857	6 950
	Albertsdal	4.3	1 408	3 053
	Alrode	4.0		20
	Florentia	3.7	2 946	3 119
	Gen Albertspark	4.7	1 130	1 344
	Mayberrypark	4.2	4 513	6 384
	Newmarket	3.3	608	625
	New Redruth	4.1	4 299	7 884
	Raceview	3.9	2 035	2 668
	Southcrest	3.8	2 175	3 184
	Verwoerdpark	3.5	5 980	8 045
	Farms	4.0		352
	TOTAL		29 951	43 628
Low	Edenpark[2]	5,8	11 023	14 823
	Thokoza	8,2	74 037	78 357
TOTAL			85 060	93 180
GRAND TOTAL			147 420	179 091

Table 3.2 Population Distribution in Alberton According to Income Levels

[1] Figures are taken from the 1991 population census and estimated for 1997 by Alberton Municipality, and do not include Phola Park. Source: "Greater Alberton Plan Data 1997 Section A".

[2] Edenpark is a suburb of Alberton.

Summary

Upper income group:	42 283
Middle income group:	43 628
Subtotal:	85 911
Lower income group:	93 180
Total population:	179 091

Table 3.3[3] below shows the gross monthly household income in June 1995; the mean household incomes per month for the various areas are:

- Alberton: R7 283
- Thokoza: R1 342
- Edenpark: R1 455

Gross Monthly Household Income	Alberton	Thokoza	Edenpark
R1 - R 499	-	-	12.1%
R500 - R799	-	11.8%	12.1%
R800 - R1 499	1.0%	28.6%	30.3%
R1 500 - R1 999	1.0%	9.1%	12.1%
R2 000 - R2 499	2.9%	10.0%	21.2%
R2 500 - R3 499	3.8%	8.2%	6.1%
R3 500 - R5 999	25.0%	4.1%	6.1%
R6 000 - R8 999	29.8%	-	-
R9 000 - R10 999	27.9%	1.4%	-
R11 000 +	8.6%	-	-
Total	100.0%	100.0%	100.0%

Table 3.3 Gross Household Monthly Income (June 1995)

[3] Source: "Greater Alberton Plan Data 1997", page 10.

3.5 Alberton Operating Budget and Revenue from Water

The municipal revenue from water sales in Alberton was estimated to be R52,5 million in 1997/1998. This was equivalent to 15% of an operating budget of some R355 million[4] for that year. The various income components of the budget are given below and shown in graphical form on Fig 3.1 below:

- Electricity: 49% (R175.1 million)
- Assessment rates: 17% (R58.6 million)
- Water: 15% (R52.5 million)
- Other: 11% (R39.5 million)
- Sewerage: 5% (R17.7 million)
- Cleansing: 3% (R12.2 million

100% (R355.6 million)

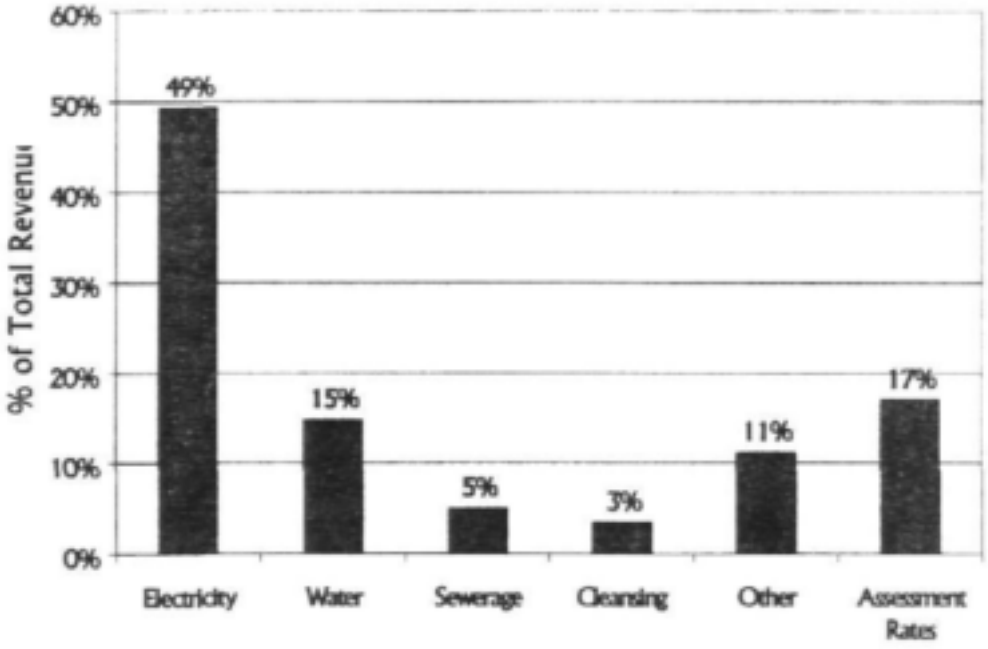


Fig 3.1 Revenue Components of the Budget

[4] Source: Greater Alberton Plan Data 1997, Section C

3.6 Overview of Water Demand in Alberton

The annual average daily demand (AADD) for water in Greater Alberton was approximately 60 800 m^3/day) in 1994[5]. Details of the various demand categories are shown in Table 3.4 below. The residential figures shown in this table include water demanded by Thokoza. With respect to the industrial demand, 36 large water users were identified in Greater Alberton, and by far the largest of these is the Alrode Brewery of SAB, with an AADD of approximately 6 500 m3 per day, i.e. about one third of the total demand.

Water Demand Categories	AADD (m^3/day)
Residential	40 605
Business	1 344
Industrial	18 883
Total	60 832

Table 3.4 Alberton Water Use[6] (1994)

3.7 Reasons for Choosing Alberton for the Research Project

The survey area covers the municipality of Alberton and the Thokoza township. These areas were chosen for carrying out the research project since they are centrally located in Gauteng Province, are in close proximity to road and rail linkages connecting Alberton and Thokoza to Johannesburg so that commuting to South Africa's premier financial centre is easy. As has been shown above, there is considerable industrial development within the border of the Alberton Municipality and many modern shops can be found in Alberton's central business district. This means that the population of the area ranges from professional to blue-collared workers and labourers making it easy to conveniently divide them into upper, middle and lower income groups for purposes of this research. In

[5] Source: Updating the Greater Alberton Master Plan, Geusten, Loubser and Stericher, June 1995, pp 19-26.
[6] Source: "Greater Albertnn Plan Data 1997".

addition discernible cultural differences exist in the area which adds an interesting dimension to the analysis from the viewpoint of understanding how different cultures manage water and what is important to them in this regard. Finally, the area has the distinct advantage of being easy to traverse. This is important as it obviates extensive travelling in the collection of data. Respondents to the CV carried out in Alberton and Thokoza were chosen from consumers that were metered so far as water supply was concerned.

CHAPTER 4 - WATER USAGE PROFILE SURVEY

4.1 Introduction

This Chapter is divided into four sections in addition to this introduction. The first section explains the purpose of the water usage profile survey; the second section discusses the methodology of the sampling technique used for arriving at this profile; the third section gives the results of the survey, and in section four some conclusions arrived at from these results are presented.

4.2 The Purpose of the Water Usage Profile Survey

The purpose of the first survey, the water usage profile survey, was to establish detailed profiles of residential water usage patterns in Alberton and Thokoza. The survey was conducted in households that were metered for water and where service accounts were paid. The survey involved determining total indoor and outdoor water consumption for a two week period in the case of Alberton residents, and a one week period in the case of Thokoza residents. The survey questionnaires (see Appendix B) established basic demographics and other household characteristics so far as water usage is concerned as perceived by the respondents to the questionnaire. These usages were not estimated by the use of measuring devices in cisterns etc. The indoor water usage components are the kitchen, bathrooms and toilets, laundry, house cleaning and miscellaneous usage, whilst the outdoor water usage comprises lawn watering, vegetable garden irrigation, the watering of trees, shrubs and flower beds, car washing and miscellaneous usage. From the results of this survey researchers conducting the CV experiment are able to explain to respondents how much water they save by changing their water usage patterns when they are presented with hypothetical changes in the price of water in Survey N° 2, the CV experiment. These behavioural changes, contingent upon hypothetical water price changes, are crucial for estimating the price elasticity of water demand for residential consumers.

Survey N° 1 proved to be a very good water consumer advisory service, among Thokoza residents and favourable comments were received in this regard. Water consumers in Thokoza thought that this type of survey should be undertaken throughout the township as people would then realise how they used water and they could, from this information, put into practice water conservation measures.

Following discussions on the results of the Water Usage Profile Survey i.e. Survey N° 1, a social scientist was requested to evaluate the approach used, with particular reference to the following points:

- The sampling methodology and the value of the results, and
- Consumers' behavioural traits which have an impact on water usage.

The social scientist's comments and evaluation are given in Appendix J.

4.3 Sampling Technique for the Water Usage Profile

4.3.1 Determination of a Random Sample

The study is based on the results of some 150 samples of a target population of 179 091 people, *cf*, Table 3.2, Chapter 3. It was surmised that two factors played a primary role in the use of water in the study area: namely income and culture. The income distribution figures were taken from the 1991 population census. In a relatively stable environment, there seemed little to suggest that a significant influx of strangers with different incomes would have occurred to invalidate these figures between 1991 and 1997. The ideal striven for in determining a random sample was to choose a blocking system such that the samples assigned to each block would be as representative of those blocks as possible. More specifically, the sample means and variances were to correspond to those of the parent populations from which they were drawn. To this end it was assumed that the classes of income declared in the 1991 population census mentioned above would have the same widths. If this were true, then the histograms made of similar income classes would allow an income distribution to be inferred. A frequency

distribution which best suited the empirical data could then be selected, and tested by goodness-of fit tests. The advantage that this would bring would be that the means and variances calculated from the experimental data of the samples could be compared with the expected means and variances of the parent populations as a check on their being representative. Unfortunately, as the class intervals reported by the census were not equal, this approach could not be implemented.

The approach then adopted was to rank as many of the predominantly white suburbs as practical in order of mean annual income, as determined in Chapter 3. The next step was to apportion the relative sample sizes in proportion to the population represented by the three groups composed of lower to middle income, middle to upper income and the predominantly black population. The sample sizes so calculated were as follows:

- 39 samples from the lower to middle income group representing 43 628 residents in Alberton
- 39 samples from the middle to upper income group representing 42 283 residents in Alberton
- 72 samples from the mainly black township of Thokoza as well as from Edenpark with 93 180 residents

4.3.2 Difficulties with the Random Sample

In attempting to interview members of the random sample generated in accordance with Section 2.3 above, the researchers were immediately faced with practical difficulties. Four main problems in gathering the generated random sample presented themselves; these were as follows:

(i) After generating the random sample it was necessary to obtain telephone numbers in order to arrange interviews. It was found that approximately 50% of the random sample was ex-directory.

(ii) Amongst those members of the sample who were listed in the directory, there was a general reluctance in many instances to allow strangers onto their property and into their homes. As a consequence, many people in the random sample would not entertain being part of a study such as this one. The crime level in the country at present seems to be the root cause of this trait.

(iii) A view was expressed by many people approached that even if they participated in the study, because of the climate of change in South Africa, it was unlikely that they would benefit personally and therefore they declined to be interviewed.

(iv) Many people refused to participate in the study because there had been other surveys concerning the provision of services from which nothing of benefit had emerged, in their view, resulting in an apathetic approach to studies such as this one.

So far as Thokoza was concerned, making arrangements for the randomly selected participants to assemble in the local church hall, which was initially considered the best way of explaining to them what the project was all about, proved impossible. This was largely due to the fact that the "community culture" in place in Thokoza required that these approaches should be made through local community leaders and not directly to individuals. The non-payment for services culture which still has some force in the area also played a role, and black Thokoza counselors advised that this would prevent some of the people selected by random sampling taking part in the survey. It was realised that this could have an adverse impact on the levels of confidence placed in the results obtained. However, it was felt to be imperative that water usage patterns from Thokoza residents were elicited. As a consequence it was decided that it would be beneficial to reduce the number of people interviewed in Thokoza from 72 to 50 and increase the sample in Alberton from 78 to 100. In the event 111 people were interviewed in Alberton itself giving a total sample size of 161.

Presented with the problems described above it became obvious that a departure from the theoretically correct random sample would have to take place. Accordingly it was decided to adopt another approach entirely for getting community participation in the project both from Alberton and Thokoza residents.

In Alberton those people selected from different income groups for the random sample, and who had agreed to take part, were interviewed. These people were then asked to nominate other people who they considered would be prepared to also take part in the survey. In addition cold canvassing via the Alberton telephone directory took place to generate further interviews, and those who agreed to be interviewed were likewise asked for names of other people who would perhaps be willing to take part in the study.

By this mean, although time consuming, the full sample level for Alberton of 100 people was reached.

In Thokoza the approach was different. Black Councilors, who incidentally were very supportive of the study, were asked to nominate people for interview, clearly only people who paid their service charges were selected and a widespread group of participants was achieved because each councilor representing different wards nominated only a certain number of people to take part in the survey. The Thokoza participants were then gathered together and the reasons for the study were explained to them in their own language (this was undertaken by a black researcher working on the project). As mentioned already, in Thokoza there was universal enthusiasm for the project and comments on its usefulness as an educational tool in water conservation were received from the participants. This new approach in obtaining the sample of 50 proved successful.

Having gathered an alternative sample of 150 people a necessary new requirement was to investigate the confidence level of this sample, i.e., to determine how random the new sample really was. This is discussed in the next section.

4.3.3 Adequacy of New Sample

In considering the adequacy of the new sample it was borne in mind that a sample is a substitute for a full count of the population from which it is drawn. The information derived from it is required not for its own sake, but to make inferences about certain characteristics of the parent population. This being so the new sample was arrived at using a method commonly known as Quota Sampling[1]. This method is common in making surveys of public opinion. Interviewers were given definite quotas of persons in different social classes, different age groups, different suburbs, etc., and were then instructed to obtain the required number of interviews to fill each quota. The quotas ensured that the total sample included approximately the right proportion of persons of the various categories which appeared in the underlying population, but the actual persons sampled to fill each quota were not necessarily representative of the underlying population in that category. This is so because the quotas were not filled by a random selection, but by the first so many appropriate persons the interviewer was able to interview. This method allowed the interviewer a certain amount of discretion when collecting the data. It must be pointed out that quota sampling, however scientific it may be made to appear, is not equivalent to random sampling, unless the quotas are filled by proper random processes. Quota-sampling interviews are undertaken on a personal basis between researchers and respondents. This is a commonly used method of collecting data from the general public and is used in many public opinion surveys and polls e.g. the well known Gallup Poll. The main advantages of this approach are:

- Responses are only elicited from respondents who are willing to be interviewed and are therefore likely to have an interest or involvement in the subject.
- A high response rate: the skilled interviewer can persuade all but the most reluctant to answer the questions.

[1] See: Karmel, P.H. and Polasek, M.: Applied Statistics for Economists. Pitman, Victoria, 1978, and Caswell, F.: Success in Statistics. John Murray, London, 1989.

- The interviewer can explain any questions, which the interviewee can not understand.
- The interviewer can check the answers to some questions – by making a visual check of water use appliances that may be in a particular home, for example. The interviewee will also be less inclined to exaggerate when answering questions about house, car, income or life-style if any exaggerations will be visibly obvious.
- More information can be collected than with other methods, as generally an interviewee will devote more time to a personal interview.

It is only fair to mention that there are some disadvantages to this method. The main ones are:

- The interviewer may, unknowingly, introduce bias by the way that questions are asked or answers recorded.
- Some people may be too embarrassed to give confidential information in a personal interview, e.g., how many times he or she uses the toilet.
- A tactless interviewer may obtain inaccurate responses through upsetting or angering the interviewee.

Great pains was taken to point out these disadvantages to Survey No. 1 field researchers so as to minimise them, in addition a small pilot survey was undertaken before the survey proper. This was conducted to test interviewer techniques and to find out if the questionnaires were valid and whether respondents could understand and answer the questions. This pilot survey yielded a positive result.

In an effort to make, what is acknowledged is not a random sample, as meaningful and as informative as possible for this study, cognisance of the central limit theory, which is one of the most important requirements in statistical sampling and involves the actual sample size, has been taken. For practical purposes, a sample size greater than 30 is large enough for the sampling distribution of the mean to be considered normal. In this survey, the number of respondents in each income group exceeded this figure.

4.4 Results of the Survey

In this section the results of the analysis of the Water Usage Profile survey are presented. To provide the maximum data in the clearest fashion, resort will be made to graphical presentations of these results with accompanying discussion. The task involved calculating for each household a perceived profile of the amount of water used both indoors and outdoors over one month. To determine these profiles from the survey results average water usage in litres from each activity was required, e.g., litres/min from showering, litres used each time a toilet is flushed, etc. The data for this exercise was obtained from Cobra Water-Tech in Krugersdorp who kindly made research on water usage, which had been gathered by them over a period of 7 years, available to EPE. A summary of this data is shown on Table I.1 in Appendix I.

4.4.1 Results

A summary of the data collected for the water usage profile survey is given in Appendix D. The database is composed of three income levels, i.e. the lower (L), the middle (M) and the upper (U) income groups, as determined in Chapter 3.

The following tables and figures present results of the analysis of the water usage profile survey[2]:

- Table 4.1and Figure 4.1: Average perceived monthly water usage per household
- Table 4.2 and Figure 4.2: Average perceived monthly water bill per household
- Table 4.3 and Figure 4.3: Perceived indoor and outdoor monthly water usage
- Table 4.4 and Figure 4.4: Perceived detail profile of monthly water usage

[2] The Tables and Figures are placed together starting at page 4-12 of this Chapter for convenience.

4.4.2 Discussion of the Results

(a) Table 4.1 and Figure 4.1

Table 4.1 and Figure 4.1 show the perceived average monthly water usage per household in the different income groups in the study area.

It will be seen that there is a 40% increase in water usage in kilo-litres per month from the lowest income group (Thokoza) to the highest income group in Alberton. The differences within Alberton i.e. from the middle income group to the upper income group is approximately 22%.

(b) Table 4.2 and Figure 4.2

Table 4.2 is the equivalent perceived average monthly bill for water used in the different income groups in the study area i.e., the bill that would result from the perceived water usage, and Figure 4.2 is the graphical representation of these results. The percentage differences in price between the different income groups are clearly the same as that obtained in (a) above.

(c) Table 4.3 and Figure 4.3

Table 4.3 shows the perceived percentage water used indoors and outdoors for the different income groups in the study area. Figure 4.3 is the resulting graphical representation.

It can be seen that there is remarkable similarity of indoor and outdoor water usage for all respondents to the survey. Specifically, the percentage usage in Thokoza is exactly the same as that for the middle income group in Alberton. It will be noted that respondents to the survey in the Alberton upper income group use a smaller percentage of water indoors (but not a smaller quantity), but a greater percentage of water outdoors, than the other respondents in the

survey. This is what could logically be expected based on the premise that the upper income group would be prepared to spend more on their gardens and outdoor living i.e., swimming pools (recorded as Other (O) in Table 4.4).

(d) Table 4.4 and Figure 4.4

Table 4.4 shows the perceived detailed percentage water profile for both indoor and outdoor water usage for the different income groups in the study area. Figure 4.4 is the resulting graphical representation.

The striking feature of the profile is that all respondents to the survey use the most water in the bathrooms, considerably more than in any other use by a factor of approximately 4 to the next highest usage i.e., toilets or gardening. Another important observation to make is the fact that in Thokoza, after the usage of water in bathrooms, the water used for laundering clothes was the highest. As a percentage it is approximately 6 times higher than the water used by respondents in Alberton. This can be explained as follows: all the respondents in Alberton use washing machines which in general use water efficiently compared to the method of washing clothes in Thokoza. In Thokoza the clothes are invariably washed by hand in baths, sinks or buckets.

Usage of water under Other (I) includes water used indoors for washing floors, windows, watering indoor plants, and in the case of Thokoza, includes in addition the widespread use of water for enemas and trumpet playing.

Usage of water under Other (O) includes outdoor cleaning, i.e., washing down patios etc., window cleaning, watering outdoor pot plants, drinking water for animals as well as for topping up or filling swimming pools.

In addition to the graphs and tables discussed above, a very preliminary analysis of water usage by family size in Alberton was undertaken. The following overall results were arrived at from this analysis:

- For households of 2, 3 and 4 people, the average water used per person per month was 7 to 8 kilo-litres
- For households of 5, 6, 7 and 8 people, the average water used per person per month was 5.5 kilo-litres

This indicates that in general the smaller the family unit, the more water each person used. It should be noted, however, that family sizes have not been divided into the various income groups so far as the results given above are concerned.

Perceived Detailed Profile of Monthly Water Usage

	Alberton Middle Income Group	Alberton Upper Income Group	Alberton Total Group	Thokoza
Average Water Usage (Kilo-litres Per Month)	23	28	26	20

Table 4.1

	Alberton Middle Income Group	Alberton Upper Income Group	Alberton Total Group	Thokoza
Equivalent Monthly Water Bill	R 43.32	R 52.74	R 48.97	R 37.67

Table 4.2

Perceived Profile of Monthly Water Usage

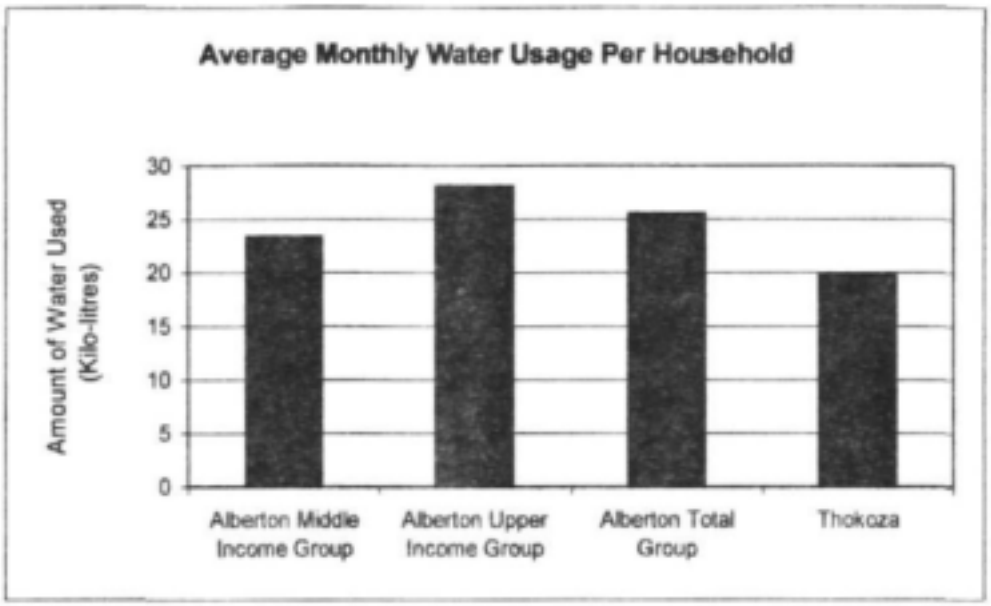


Fig 4.1

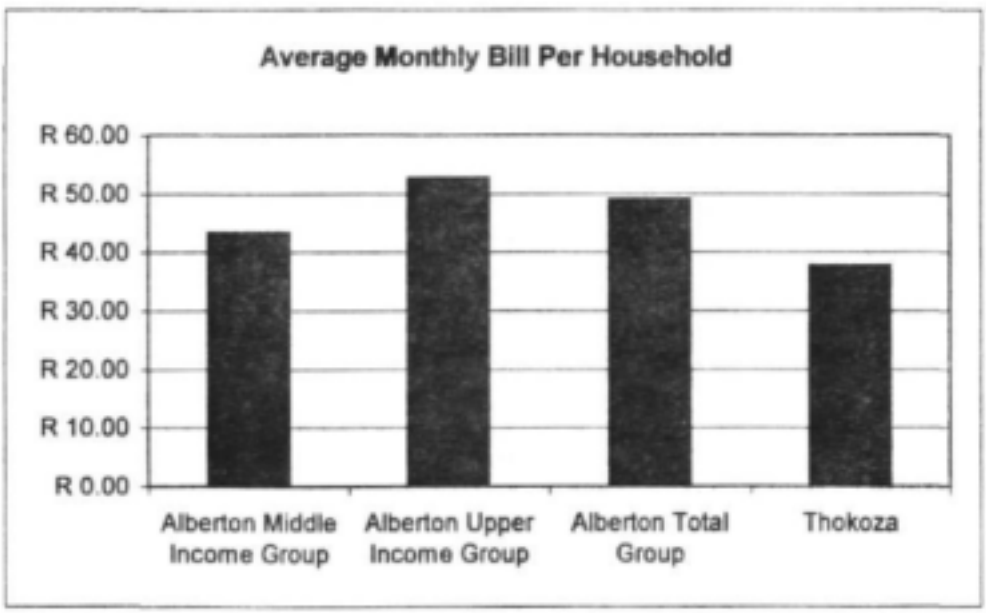


Fig 4. 2

Perceived Detailed Profile of Monthly Water Usage

	Alberton Middle Income Group	Alberton Upper Income Group	Alberton Total Group	Thokoza
Indoor usage	83%	80%	81%	83%
Outdoor usage	17%	20%	19%	17%

Table 4.3

	Alberton Middle Income Group	Alberton Upper Income Group	Alberton Total Group	Thokoza
Bathroom	62%	59%	61%	52%
Toilet	13%	14%	14%	10%
Laundry	2%	2%	2%	13%
Kitchen	4%	4%	4%	5%
Other (I)	1%	1%	1%	3%
Garden	14%	14%	14%	10%
Car	1%	1%	1%	3%
Other (O)	2%	5%	4%	4%

Table 4.4

Perceived Detailed Profile of Monthly Water Usage

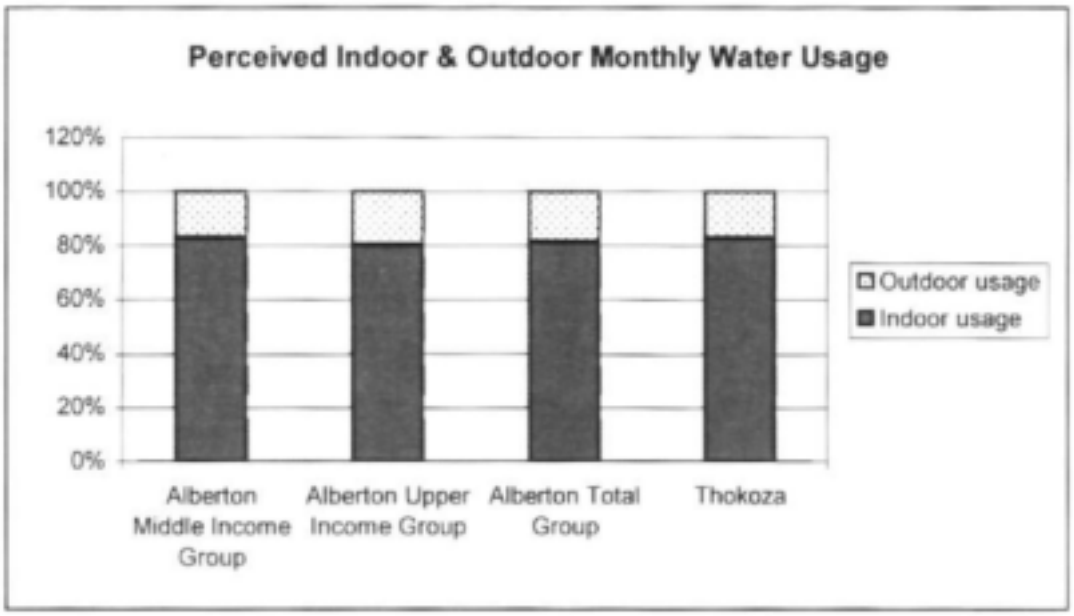


Fig 4.3

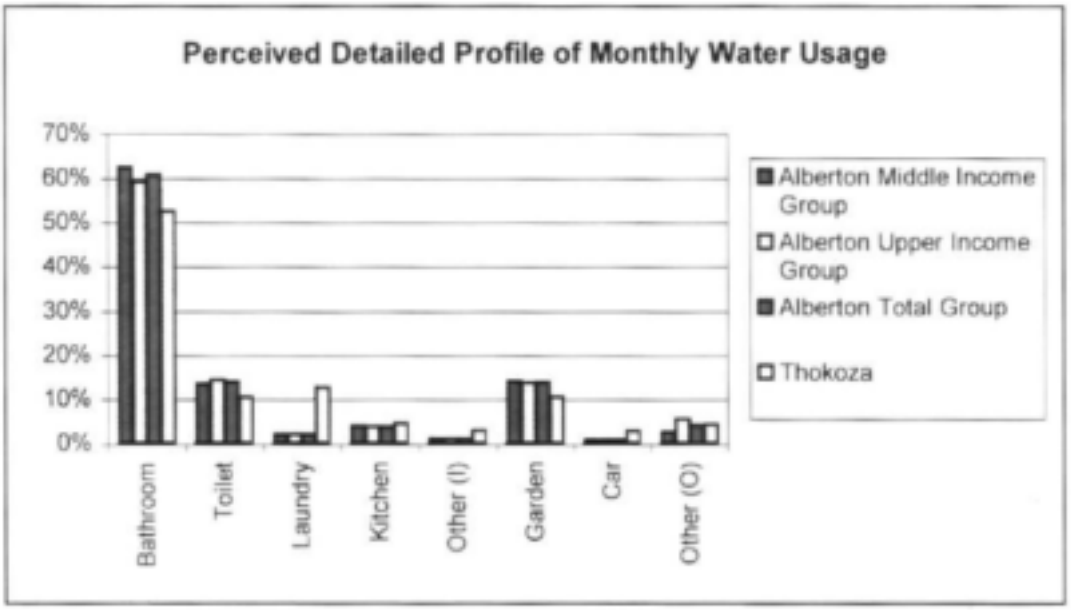


Fig 4.4

4.5 Conclusions

The perceived water usage profile survey involved face-to-face interviews, the advantages of this form of survey has already been noted. In addition to these advantages, of importance is the information that the researcher gleans in general awareness from responses to the survey, and which does not necessarily emerge from the respondent's answers to the questionnaire itself. The conclusions given below include such information.

(a) Higher income groups living in Alberton were less aware of the scarcity value of water than the lower income group living in Thokoza. This was probably because higher income groups were historically used to having adequate amounts of potable water delivered to their homes, whereas the opposite is true for many of the residents of Thokoza. Furthermore, the residents in Thokoza seemed to be more aware of the privilege attached to having potable water on tap than the residents of Alberton who considered having water on tap as a right.

(b) The Thokoza residents involved in the study also saw this survey as a good educational tool; they believed that being confronted with their perceived water usage patterns aided them in learning how to manage water in a more efficient manner. This underpins what has been said before in clause 2.2 above i.e., the residents of Thokoza thought Survey No 1 was a useful vehicle for educating people concerning their water usage patterns, and that such surveys should be widely undertaken in black townships. By this means, Thokoza residents thought that water could be used more effectively and thereby water bills could be kept to a minimum.

This finding presents a curious dichotomy; on the one hand Thokoza residents appeared to understand water scarcity value quite well[2] but on the other hand their ability to manage this scarce resource was scant.

[2] A parallel can be drawn here with a study done by EPE in Natal on the economic value of groundwater (WRC Report No. 639/1/96) where the inhabitants of Ndaleni were also subjected to a scarcity of water, and had a well developed awareness of its scarcity value.

Thokoza residents were unanimous in declaring to the Thokoza field worker that Survey No. 1 should be distributed widely throughout, not only Thokoza, but other black townships as well. This would certainly aid township dwellers in identifying which actions used most water and thus they would be able to conserve water more efficiently. Survey participants in Alberton were less concerned with learning how to conserve water and did not view the water usage profile survey as a particularly important educational tool. The reasons for this may be found to some extent in the fact that Alberton residents had always had access to potable water.

(c) Dishwasher owners did not use the machine to the exclusion of washing dishes by hand; in any event this was not a commonly owned appliance in Alberton and Thokoza. Microwave ovens on the other hand were extensively used in Alberton thus effectively saving water for cooking purposes.

(d) Survey respondents' water drinking habits in Alberton and Thokoza did not conform to medically recommended amounts in general, i.e. about 2 litres per person per day.

(e) Bathing was generally preferred to showering in both Alberton and Thokoza and a large number of survey respondents mentioned that one bath was run for two people.

(f) Whilst most respondents to the survey in Alberton possessed washing machines, it was apparent that hand washing of laundry was still regularly undertaken. In Thokoza on the other hand, respondents to the survey invariably washed clothes by hand, washing machines being rare in the township.

(g) The washing of windows in both Alberton and Thokoza varied considerably from house to house with the interval between such cleaning being 31 – 365 days, i.e., once monthly to once yearly.

(h) Only a very small percentage of respondents to the Water Usage Profile survey had a vegetable garden where regular watering was necessary; so far as the watering of lawns, trees and shrubs are concerned three schools of actin prevailed, these being:

(i) To let nature take its course, i.e., no mechanical irrigation was attempted;

(ii) Watering would take place only under extreme conditions, i.e., when plants etc. were completely dried out and in danger of dying, and

(iii) Watering would take place regularly as a matter of course.

Whilst the sample interviewed for the water usage profile survey could not be classed as a statistically random sample, every effort was made to capture a representative view of water usage in Alberton and Thokoza. Representatives of upper, middle and lower income levels were included and in addition representatives of each and every suburb in the Alberton and Thokoza area were interviewed, furthermore the central limit theory was adhered to and each income group had a sample exceeding 30.

CHAPTER 5 - THE CONTINGENT VALUATION SURVEY

5.1 Introduction

This Chapter is divided into four sections in addition to this introduction. The first section explains the purpose of the Contingent Valuation survey; the second section discusses the methodology of the sampling technique used in this survey; the third section provides the results of the survey, and in section four, conclusions are drawn from the results of the survey.

5.2 The Purpose of the Contingent Valuation Survey

The purpose of the second survey, the Contingent Valuation Method Survey (CVM), was to establish how the 150+ water consumers interviewed in this study would amend their water usage patterns as the price of water increased. Clearly the sample of interviewees was the same as those that participated in Survey No. 1, i.e. the first survey, where a perceived water usage profile was generated for each consumer.

The tasks for the CV Survey were brought forward from the period starting the 2nd June 1998 (the originally programmed date for its commencement) to the period starting 1st April 1998. This was done in view of the problems encountered in undertaking the first survey, i.e. the water usage profile survey. It was felt that it would be advisable to complete all survey work as soon as possible whilst the mood of co-operation still existed with the survey participants; in addition there was no theoretical reason for having a long interval between the two surveys. The decision to bring this survey forward was therefore implemented and the CV survey was carried out without the difficulties experienced in undertaking the Water Usage Profile Survey. Respondents remembered being involved in Survey No. 1 and were without exception enthusiastic and ready to participate in the CV survey and showed considerable interest in their individual water usage profiles. There was then an educational dimension to the CV Survey involving consumers learning to value water.

5.3 Sampling Technique for the CV Survey

5.3.1 Method of Collecting Data

The modus operandi for undertaking the survey dictated that the field researchers first obtained the respondent's acceptance of his or her water perceived usage profile. Where agreement could not be obtained the profile was modified there and then and the revised profile was used in the CV experiment. Out of the 150+ respondents only 9 did not agree with the profile prepared from the responses to Survey No. 1 and wished to amend their profile.

The next stage of the CV experiment was to examine how respondents' water usage patterns changed as the tariff of water was increased by 50%, 100% and 150% above the price obtained when their water usage profiles were determined. A manual explaining how to acquire this data was prepared for use by the Field Researchers involved in this exercise (see appendix F). A seminar was also conducted with them to explain the importance of the CV survey thus ensuring that accurate data would be collected.

In the CV experiment, the interviewer had on occasions to re-examine certain answers to the questions posed concerning water saving actions as the price of water was increased, since sometimes a respondent inadvertently tried to save water in an activity where it was clear he or she was already using a minimum amount of water already, e.g. water for cooking. As a consequence, the interviewer was constantly cross-checking the original perceived water usage profile and by this means greater confidence was engendered in the results of Survey No. 1 as the CV survey proceeded. Because of this constant cross checking, the results obtained from the CV Survey can also confidently be accepted as accurately reflecting the behaviour of water users under an increasing water pricing regime.

5.3.2 CV Survey Database

A summary of the data collected for the CV Survey, i.e. Survey No.2, is given in Appendix H (CV Survey Database). The database is composed of three income levels, i.e. the lower (L), the middle (M) and the upper (U) income groups and shows the changes in water usage as the price of water is increased.

5.4 Results of the Survey

In this section the method of calculating the price elasticity of demand for water is demonstrated and the results of the analysis of the CV Survey are presented. To provide the maximum data in the clearest fashion, resort will once more be made to graphical presentations of these results with accompanying discussion.

5.4.1 Method of Calculating the Price Elastcicity of Demand for Water

The nature of water is such that it is universally used everyday by all people, and the price in South Africa has historically been relatively very low. Under these circumstances, it was agreed that using small increases in the price to determine the price elasticity of demand for water would not yield a sensible result since the reaction of people to these changes in price would be insignificant. Hence in order to gauge the reaction of people to increases in the price, these have had to be relatively large. This incidentally was the case for the Australian study mentioned already. Understanding these circumstances it was considered appropriate to use the arc elasticity for calculating the price elasticity of demand.

The arc elasticity is a measure of the *average* elasticity, that is, the elasticity at the midpoint of a chord that connects two points A and B on a demand schedule (i.e. a specific consumption at specific point in time) defined by the initial and new price levels as shown in Figure 5.1 below. The measure of the arc elasticity is an approximation of

the true elasticity of the section AB (which varies at every point along that line) of the demand schedule, which is used when only the two points A and B on the demand schedule are known. Clearly the more convex to the origin the demand schedule is, the poorer the linear approximation attained by the arc elasticity formula. In this respect it should be noted that in this study, the demand schedules for the various income groups interviewed were found by regression analysis from the results of Survey No, 2 and were all very close to being linear.

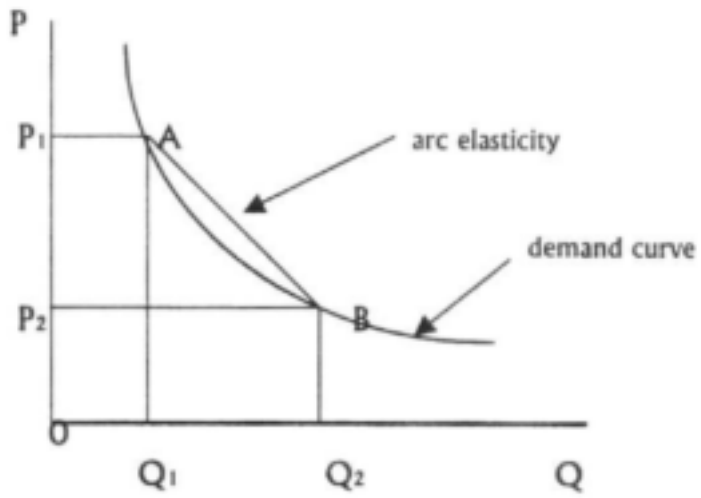


Fig 5.1 Arc Elasticity of Demand

Referring to Fig 5.1 above, if the price changes are appreciable, the following formula is used for measuring the *arc elasticity* of demand:

$$e_D = \frac{\Delta Q}{\Delta P} \cdot \frac{\frac{(P_1 + P_2)}{2}}{\frac{(Q_1 + Q_2)}{2}} = \frac{\Delta Q}{\Delta P} \cdot \frac{(P_1 + P_2)}{(Q_1 + Q_2)} = \frac{(Q_1 - Q_2)}{(Q_1 + Q_2)} \cdot \frac{(P_1 + P_2)}{(P_1 - P_2)} \quad \ldots\ldots\ldots(1)$$

So far as this study was concerned, for each category of income group, the arc elasticity of demand for water was determined as follows using the above formula:

- A total bill for the particular income group considered was established by summating the water bill of all the households within the group at the present price of water. This total bill was divided by the summated quantity of water used for the

particular group, to yield an average unit price of water for the income group considered. Thus one point on the demand curve for the income group was established i.e. the total quantity of water used by the group and the average unit price of water established. This point represented the status-quo position with regard to water usage in a particular income group.

- Similarly, three other points on the demand curve for the same income group considered were established from the answers to questions in the CV Survey, i.e. when the present price of water was increased by 50%, 100% and 150%.
- Using the information obtained for the four points, a linear regression analysis was undertaken to determine the equation of the demand curve for the particular income group considered. The arc elasticity of demand for water was then determined using the formula described above.

5.4.2 Results

The following tables and figures present results of the CV analysis[1]:

- Table 5.1 and Fig 5.2: Results of the CV survey – the price elasticity of demand for water for the various income groups
- Figure 5.3: Effect of the increase in the price of water on indoor water usage by the various income groups
- Figure 5.4: Effect of the increase in the price of water on outdoor water usage by the various income groups
- Figure 5.5: Effect of the increase in the price of water on total water usage by the various income groups

[1] The Tables and Figures are placed together starting at page 5-9 of this Chapter for convenience.

5.4.3 Discussion of the Results

(a) Table 5.1 and Figure 5.2

Table 5.1 and Figure 5.2 show the price elasticity of demand for water for the various income groups in the study area. With respect to this table and figure, the following observations are made:

- The outdoor price elasticities of demand are considerably more elastic than for indoor water usage for all cases. This is to be expected because as the price of water increases, water savings are made more easily in outdoor usage. Also, water used for outdoor purposes has elements of luxury use attached to it, for example washing motor cars, and is therefore more elastic than water used for indoor use which has a greater utilitarian aspect, for example water used for cooking or drinking..

- The price elasticities of demand for outdoor water usage in the Upper (U) and Middle (M) income groups are almost the same. This shows that these income groups have similar mores with regard to such usages, e.g. the utility of their garden to the family.

- The price elasticities of demand for indoor water usage for all income groups in the study area is almost the same. From the trend of the Upper (U) and Middle (M) income groups for indoor water usage, it could be expected that the Lower (L) income group would be more inelastic. As this is not the case, it is suggested that the lower income group may already be using the minimum amount of water necessary for indoor use, and because of their limited disposable income, they have to reduce their indoor water usage even further as the price of water increases, bringing their water usage below their minimum comfort level. It is noted that the converse of this argument could imply that the Upper (U) income group indoor water

usage should be more inelastic than that of the middle and lower income groups, and this is indeed the case, i.e. their disposable income is sufficient to cover any increases in the price of water. From these observations it is suggested that:

(i) The poor cannot afford to pay more as the price increases, indicating that their usage of water is for essential purposes rather than for luxury purposes; and

(ii) The upper income group (U) has had a propensity to consume more water than other income groups, but nevertheless increases in the price of water seem to encourage them to reduce water consumption in the short-term.

- The price elasticities of demand for total water usage in the different income groups demonstrate that as disposable income falls, less water is saved with a 100% price increase. This means that the Upper (U) income group can save more water than the other two income groups because they have that water to save, i.e. they may have the propensity to use more water for luxury purposes than the middle and lower income groups. Likewise, for the Middle (M) income group when compared with the Lower (L) income group.

(b) Figures 5.3 to 5.5

These figures describe the effect of the price increase of water on the usage of water for the various income groups in the study area. The following observations are made:

- As the price increases, there is a tendency for all income groups to reduce water usage.

- It is clear that the Upper income group (U) has a propensity to use more water in both indoor and outdoor usage, then the other income groups as demonstrated by the amount of water they are able to save as the price increases. This confirms the comment made above about the higher income levels, i.e. the elasticities of this income group are more elastic (indoors and outdoors), than those of the other income groups.

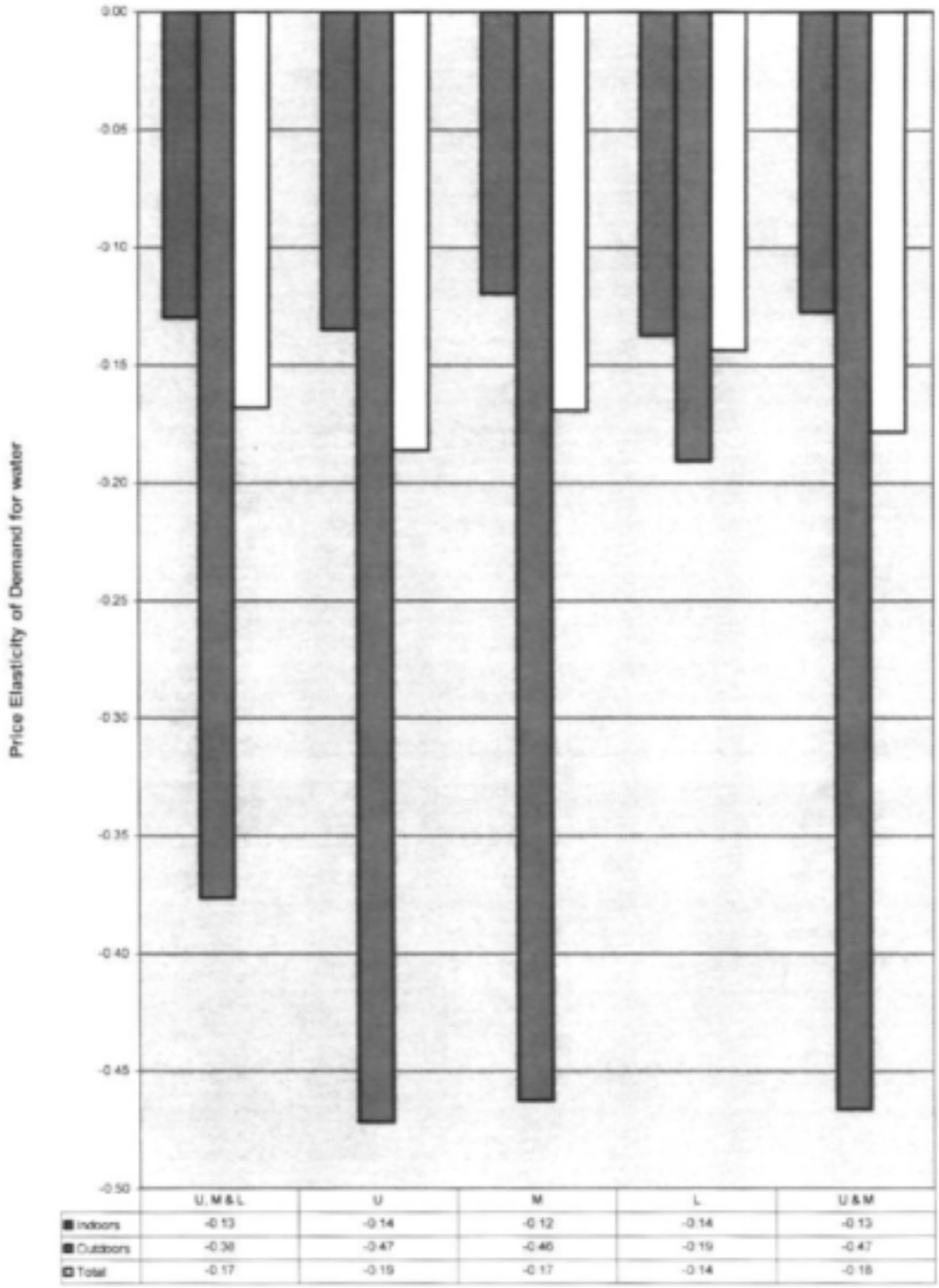
- The lower income group (L), because of their limited disposable income, have to decrease their use of water as the price of water increases. This is demonstrated forcibly in Figure 5.3 (indoor water usage) where it is seen their reduction is greater than the Middle income group (M). So far as outdoor usage is concerned, Figure 5.4, the lower income group's water usage is quite small, and therefore the reduction in water usage as the price of water increases is also very small.

Results of CV Survey
Price Elasticity of Demand for Water

Description of group	Income Category	No. of Respond.	Price Elasticity of Demand		
			Indoors	Outdoors	Total
Upper, middle and lower income groups	U, M & L	161	-0.13	-0.38	-0.17
Upper income group	U	52	-0.14	-0.47	-0.19
Middle income group	M	59	-0.12	-0.46	-0.17
Lower income group	L	50	-0.14	-0.19	-0.14
Upper and middle income groups	U & M	111	-0.13	-0.47	-0.18

Table 5.1

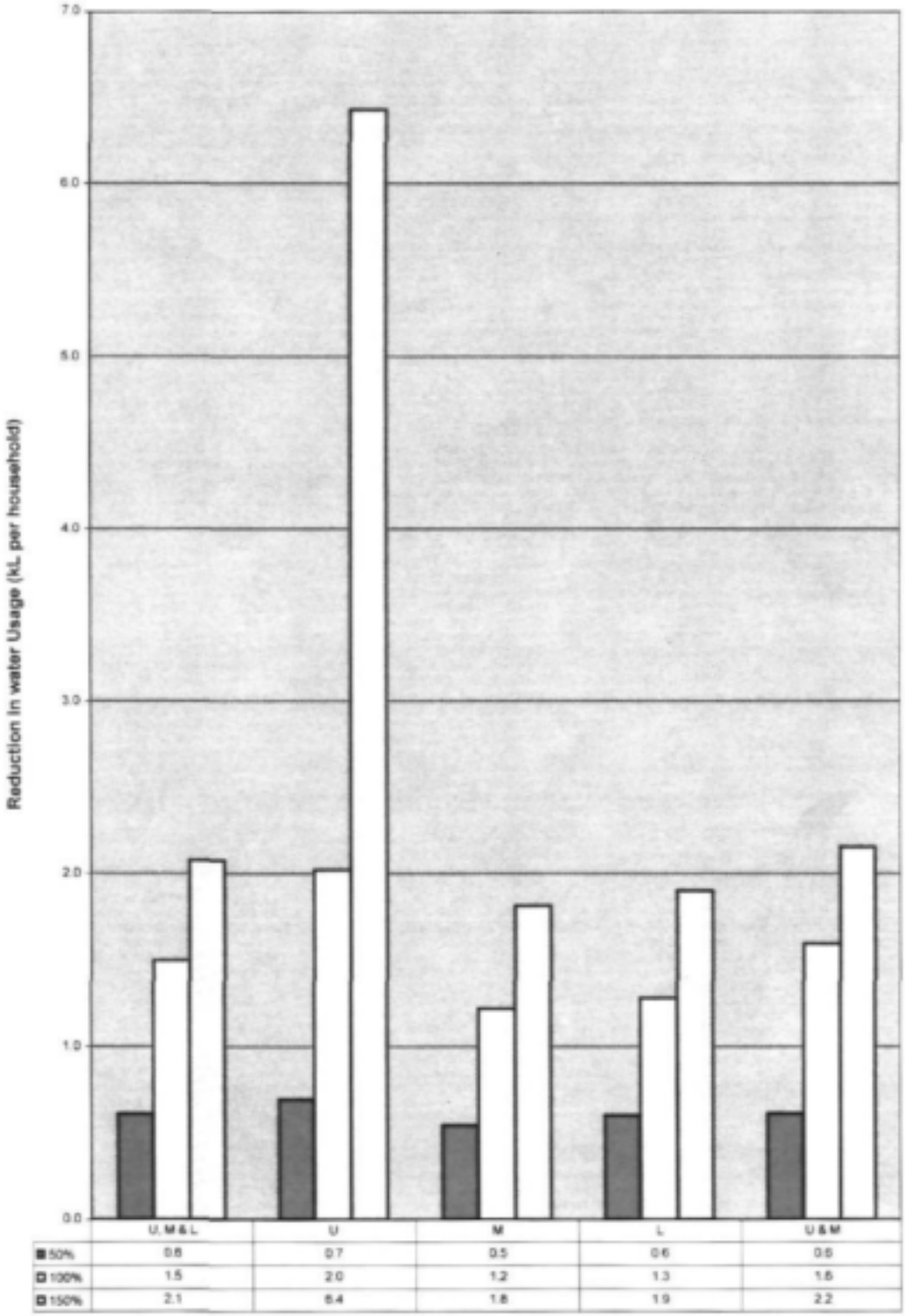
Price Elasticity of Demand for Water for the Various Income Groups in the Study Area



	U, M & L	U	M	L	U & M
Indoors	-0.13	-0.14	-0.12	-0.14	-0.13
Outdoors	-0.36	-0.47	-0.46	-0.19	-0.47
Total	-0.17	-0.19	-0.17	-0.14	-0.18

Figure 5.2

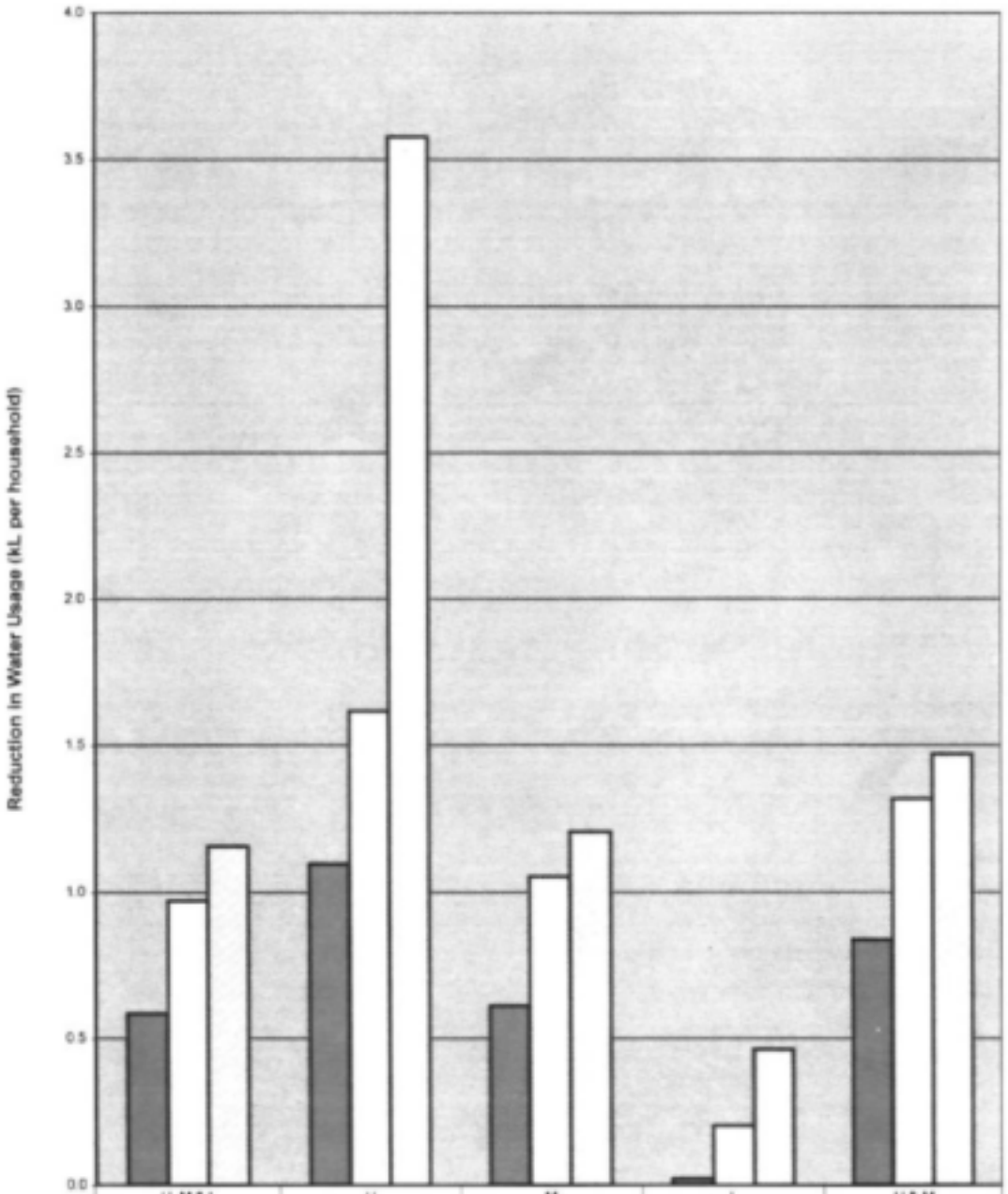
Effect of the Increase in Price of Water on Indoor Water Usage by the Various Income Groups in the Study Area



	U, M & L	U	M	L	U & M
50%	0.6	0.7	0.5	0.6	0.6
100%	1.5	2.0	1.2	1.3	1.6
150%	2.1	6.4	1.8	1.9	2.2

Figure 5.3

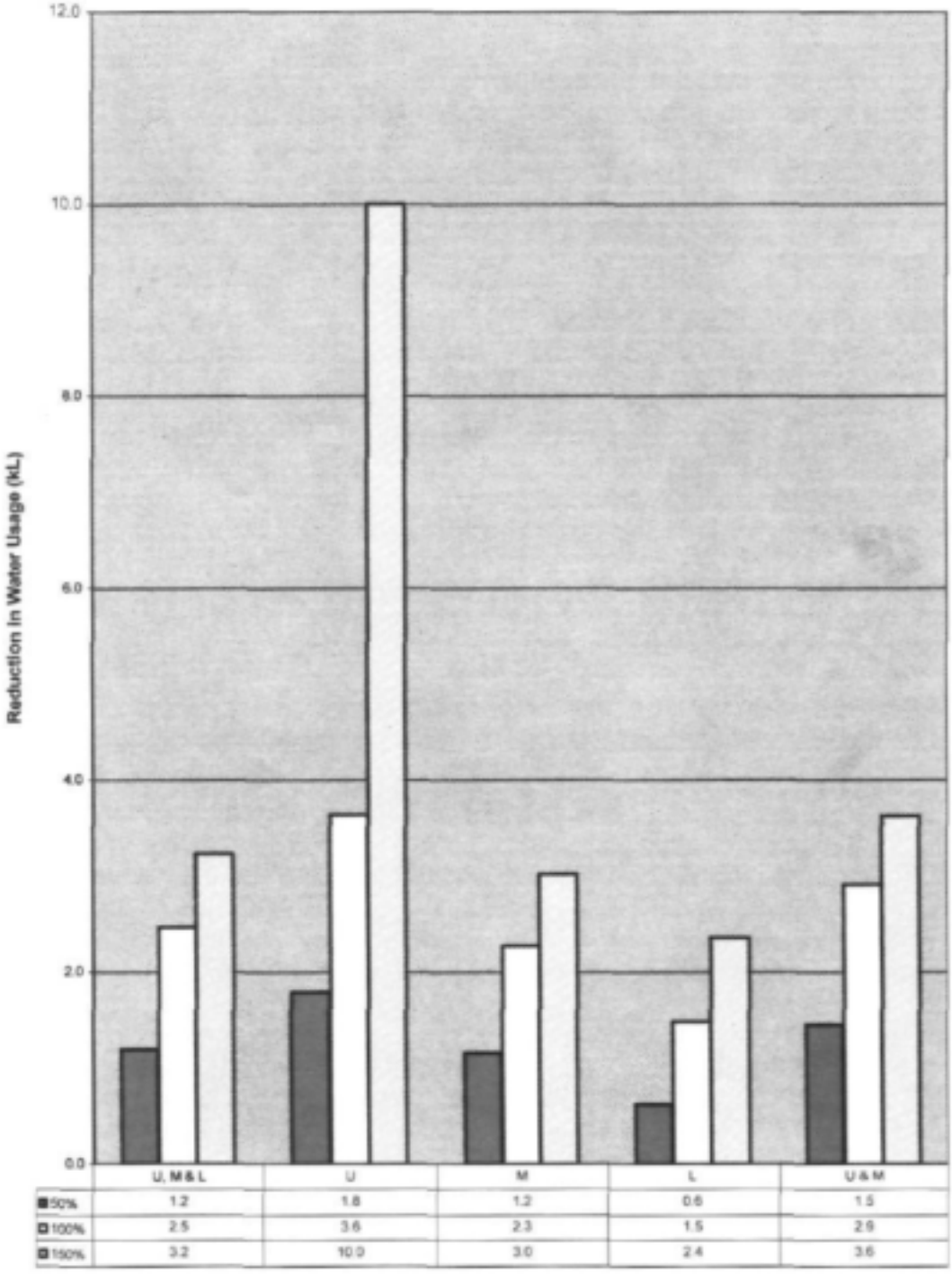
Effect of the Increase in Price of Water on Outdoor Water Usage by the Various Income Groups in the Study Area



	U, M & L	U	M	L	U & M
50%	0.6	1.1	0.6	0.0	0.8
100%	1.0	1.6	1.1	0.2	1.3
150%	1.2	3.6	1.2	0.5	1.5

Figure 5.4

Effect of the Increase in Price of Water on Total Water Usage by the Various Income Groups in the Study Area



	U, M & L	U	M	L	U & M
50%	1.2	1.8	1.2	0.6	1.5
100%	2.5	3.6	2.3	1.5	2.9
150%	3.2	10.0	3.0	2.4	3.6

Figure 5.5

5.5 Conclusions

This section is divided into two parts; firstly a broad discussion on the basic determinants that have to be considered in estimating the price elasticity of demand of a commodity is presented. Secondly, comparisons are made between the price elasticity of demand for water estimated from this study with the price elasticity of demand from other studies.

5.5.1 Price Elasticity of Demand: Basic Determinants

There are three basic determinants that have to be considered in estimating the price elasticity of demand. These are:

- Firstly, the availability of substitutes; in this case the demand for a commodity is more elastic if there are close substitutes for it. In the case of water, broadly speaking there are no substitutes, e.g. even cold drinks which may be seen as substitutes, are essentially made from water. Hence, since there are basically no substitutes, an inelastic demand schedule would be expected for water usage in the short-run. Referring to Table 5.1 above, for total water usage, i.e. indoor and outdoor water use, this is found to be the case; the values of the price elasticity of demand range from -0.14 to -0.19.
- Secondly, the nature of the need for water is important so far as the price elasticity of demand is concerned. In general where water is used for luxury purposes, i.e. washing a motor car, for filling or topping-up swimming pools, for watering exotic flora species in gardens that require lots of water etc., a more elastic demand schedule would be expected. Again referring to Table 5.1 above, it can be seen that for outdoor usage of water for such purposes the price elasticity of demand is indeed more elastic than that for water used for indoor purposes, which is used for more utilitarian purposes.

- Thirdly the time period concerned, i.e. demand is more elastic in the long run. Over a period of time as people understand water management better, the demand schedule is likely to become more elastic. This is clearly demonstrated in the upper income group in Alberton. From the Water usage Profile Survey i.e. Survey No. 1, it was observed that this group had a propensity to use more water for luxury purposes and it was expected that as the price of water increased, their demand schedule would continue to be relatively inelastic. Instead however, as their understanding of their use of water became more defined over time, their demand schedule became more elastic, i.e. as the price of water increased, they began to save more water.

5.5.2 Comparative Analysis

The price elasticity of demand for residential water usage found in this study is now compared with the price elasticities found in several other studies also for residential water usage. For ease of comparison, the following two tables are used:

- Table 5.2 below compares the price elasticity of demand for total water usage in the short-run in various international studies. All of these international studies, except for the last two in Table 5.2, have used a macro-economic approach for determining the price elasticity of demand.

- Table 5.3 below compares the short-run price elasticities of demand for indoor, outdoor and total water usage found in this study with a similar study carried out in Perth, Australia. These comparisons are particularly important since the methodology in both studies were the same, i.e. a CVM experiment.

Researcher/s	Date	Location	Price Elasticity
Carver and Boland	1969	Washington D.C.	-0,1
Agthee and Billings	1974	Tucson, Arizona	-0,18
Martin et al	1976	Tucson, Arizona	-0,26
Hanke and de Mare	1971	Malmo, Sweden	-0,15
Gallagher et al	1972/3 & 1976/7	Toowoonba, Queensland	-0,26
Boistard	1985	France	-0,17
Thomas and Syme	1979	Perth, Australia	-0,18
Veck and Bill[2]	1998	Alberton & Thokoza, South Africa	-0,17

Table 5.2 Comparison of Short-Run Price Elasticities for Total Water Usage[3]

Researchers	Date	Location	Price Elasticity		
			Indoor	Outdoor	Total
Thomas and Syme	1979	Perth, Australia	-0,04	-0,31	-0,18
Veck and Bill[2]	1998	Alberton & Thokoza, South Africa	-0,13	-0,38	-0,17

Table 5.3 Comparison of Short-Run Price Elasticities for Indoor, Outdoor and Total Water Usage

[2] Of Economic Project Evaluation (Pty) Ltd (EPE)
[3] CV methods were undertaken by Thomas and Syme and Veck and Bill, the remaining studies used short-term macro-econometric methods.

Firstly, it is important to emphasise that the figures quoted in the tables above are all short-run price elasticities for the demand for water. It is clear that the results are very compatible in both tables. It will be observed from table 5.2, in the international case studies, the short-run price elasticities of demand for total water usage range from –0.1 to –0.26. The literature reports short-run average price elasticities of demand for several international studies to be –0.21 as against –0.17 found in this study. This gives considerable confidence in the figures obtained from this study.

Table 5.3 offers a better comparison between this study and an international study undertaken in Perth, Australia, i.e. both the indoor, outdoor and total price elasticities of demand for water can be compared. The method of approach in these two studies is also directly comparable, as is the range of the price increase considered. In addition, different levels of income were also considered in both these studies. The price elasticity of demand for indoor water use in Perth is seen to be more inelastic compared to this study, whereas the outdoor elasticity is very comparable, i.e. –0.31 in Perth and –0.38 in Alberton/Thokoza. It is suggested that the large difference in the indoor price elasticity of demand for water between Perth and Alberton/Thokoza is because of the severe drought in Perth which occurred in the late 1970's prior to the Australian study being undertaken. As noted already a consequence of this drought, restrictions were imposed on water use and consumers were encouraged on television and in the press to conserve water. It is suggested that this educational process in Perth enabled consumers to use water very efficiently indoors and give them a well developed appreciation of the scarcity value of water. In South Africa, whilst restrictions have been imposed in the past, an awareness of the scarcity value of water has not been engendered amongst previously privileged white South African consumers to the same extent that exists in Australia. For the total water usage, the price elasticity of demand are almost identical, -0,18 in Perth and -0,17 in Alberton/Thokoza.

The literature shows that in general it can be expected that the effect on water use due to a price increase is substantially greater in the long-run than in the short-run. This is demonstrated by the large price elasticities of demand for the long-run as compared to the short-run. This may explain the mean price elasticity quoted in a paper by J.A. Döckel[4] for white households in 26 municipalities in the present Gauteng, as –0.69; this figure tends to agree with the average long-run price elasticity of demand of –0.6 that can be found in the literature for several international studies.

Reasons for the differences between the long-run and the short-run price elasticity of demand have been suggested by Carver and Boland (1988), these are:

Firstly, there exists imperfect information about water consumption and the impacts of price changes in the short-term. Once consumers become more knowledgeable, however, they become aware of the potential benefits of water conservation, efforts toward reducing consumption thus increase. This trait has been demonstrated in Alberton and Thokoza.

Secondly, consumers fail to differentiate between real and nominal prices in the short-term. In the long-term, if they notice that the real price of water has risen, then they may choose to make the necessary investments to adopt water-efficient appliances, so as to change their water using habits. They may also adopt practical actions such as planting indigenous flora in their gardens thus saving water. This is a trait that has been demonstrated in the western states of the USA.

It is therefore important to distinguish the difference between the short-run and long-run price elasticities of demand for water, since in the long-term greater savings in the consumption of water can be anticipated, as the elasticity in this case is greater. Yepes *et al* (1975) suggest that in the short-run the price elasticity of demand for water on average is approximately –0.3, whilst in the long-run, elasticities average –0.6.

[4] J.A. Döckel: The Influence of the Price of Water on Certain Water Demand Categories, Agrekon, volume 12, No. 3, July 1973.

CHAPTER 6 - THE ECONOMETRIC MODEL

6.1 Introduction

This Chapter is divided into five sections in addition to this introduction. The first section gives the background to the approach used in this study for determining the price elasticity of demand for water in Alberton by means of an econometric model; the second section outlines a general macro-econometric model described by Thomas and Syme (1988) for doing this; the third section describes the specific macro-econometric model developed in this study for Alberton; the fourth section gives the results obtained from exercising the Alberton model, and in section five, conclusions based upon these results are given.

6.2 Background

As mentioned in Chapter One, in the past the approach for determining the residential demand for water as a consequence of price increases has been dominated by macro-econometric analysis. In this study the estimation of the short-term residential price elasticities of demand for water for different income groups was determined by means of CVM. It was hoped that these elasticities could be checked by means of a simple macro-econometric model. The macro-econometric model described was a multiple regression model containing a number of variables such as household income, restrictions in water usage, the price of water and rainfall characteristics. In the event upon exercising the model no meaningful price elasticities of demand could be found for purposes of comparison with those arrived at by means of the CVM. This was because in the database of water usage in the shorter term at Albertn, price increases over the period considered were not large enough to have an impact on the model. It was therefore decided that an attempt would be made to estimate the long-run price elasticity of demand for residential water in Alberton, using a new data base of exogenous and endogenous variables which

had been gathered over 8 years. These results could then be compared with the values quoted in the literature (particularly the study by JA Döckel in South Africa).

6.3 The General Model

The model that was envisaged to estimate the residential price elasticity of demand in Alberton was based on a general model successfully used by Thomas and Syme (1988) in the Australian[1] case study already referred to and which was formed the basis for the study undertaken in Alberton. The Thomas and Syme econometric model estimates an empirical demand function by ordinary least squares regression, subject to tests for goodness to fit, significance, satisfactory error bounds for coefficients, noncolinearity, and absence of serial correlation of residuals. The formulation of the general model was as follows:

$$Q = f(P, D, Y, W, R, H, B) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6.1)$$

Where Q = annual or monthly consumption of water of the average household (kL);

P = marginal price of water facing the average household (c/kL);

D = Taylor-Nordin "income difference" between what the typical consumer actually paid for water and what would be paid if all water were purchased at the marginal rate;

Y = average household income;

W = annual precipitation, mm;

R = water restrictions;

H = average household size;

B = a technology variable, percentage of households which used a private groundwater bore-hole or well;

1 Because of data availability in Australia, Thomas and Syme were able to compare their CV estimates of price elasticities of demand with those derived from the results obtained by econometric analysis.

The dependent variable, water consumption per household, included all separate houses, duplexes, and triplexes served by the metropolitan system. Flats and apartments were excluded.

The Taylor-Nordin income difference variable was utilised to test for the effects of change in the pricing structure, and was calculated as follows:

$$D = QP - S/H$$

where Q and P are as defined above, and S is "the total water sales" (excess consumption payments received by the Perth Metropolitan Water Authority), and H is the total number of households.

The average household income at constant 1981 prices was included in the model to account for variations in the purchasing capacity of water consumers.

6.4 Econometric Model for Alberton

The econometric model for Alberton differed from the Thomas and Syme model because the marginal price of water for Alberton was not known, the average price of water was therefore used, consequently the Taylor-Nordin variable D was not included in the Alberton model; the variable B was also not included as the number of bore-holes used in Alberton was insignificant. The final form of the model for Alberton was therefore the following:

$$Q = f(P, Y, W, R, H,) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6.2)$$

Where Q = monthly consumption of water of the average household in Alberton and is based on the annual average daily demand for residential usage (AADD) (kL);

P = average price of water facing the average household (c/kL); this was obtained by dividing the monthly water bill for the average household by the monthly consumption;

Y = average household income for Alberton, at constant 1998 prices; this was included in the model to account for variations in the purchasing capacity of water consumers. This information was obtained from the CSS 1991 Population Census.

W = annual precipitation in Alberton in mm;

R = water restrictions; the variable used in the equation was based on whether restrictive water measures had been imposed on water consumers for the particular year or not;

H = average household size in Alberton; this was obtained from population and household figures;

The time series data that has been used for exercising the model was obtained from information contained in the Greater Alberton Master Plan (June 1995) and from further information that could be gathered from the municipality. Only data for the period 1986 to 1993, i.e. 8 years, could be used for the following reasons:

- There is insufficient data available prior to 1986 for inclusion in the econometric model;
- During 1994, the price of water in Alberton was reduced for the lower end consumers, i.e. for quantities of water less than or equal to 30 kilo-litres; however, for water quantities exceeding 30 kilo-litres, the price of water was increased. This has resulted in a discontinuity in the price of water and as a result, it was concluded that it would be better not to include data from this period.

Thokoza was also excluded from the econometric model as they became part of the Alberton municipality only in 1995.

Despite diligent search for data[2], it can be said that information concerning detailed historical water usage in Alberton over a reasonable period of time is unavailable.

6.5 Results of the Model

Using simple multiple regression analysis with the data mentioned above and summarised in Table 6.1 below, the model yielded a medium-term to long-term price elasticity of demand for water of -0.73. The model gave a reasonable good fit of $r^2 = 0.904$; however poor F and T statistics were obtained, as shown in Tables 6.2 and 6.3. The unsatisfactory diagnostics obtained for this model suggest that the model is not useful for predicting the medium to long-term price elasticity of demand with a degree of confidence.

[2] The Alberton Municipality is commended for their support in trying to obtain and supply all relevant information that was available.

Macro-Econometric Input Data

Year	Average Water Consump. per HH per month (kL)	Average Water Tariff (c/kL) (1998 value)	Annual Average Rainfall (mm)	Water Restrict. (See note below)	Average HH Size	Average Annual Income (Rand) (1998 value)
1986	25.21	144	700	1 (yes)	2.8	77 922
1987	23.55	158	800	1 (yes)	2.9	76 883
1988	26.41	147	850	1 (yes)	2.9	76 311
1989	27.41	151	900	0 (no)	3.0	77 967
1990	29.40	159	600	0 (no)	3.0	75 419
1991	31.88	164	700	0 (no)	3.1	74 342
1992	36.72	173	550	0 (no)	3.2	74 661
1993	32.54	181	600	0 (no)	3.2	75 125

Table 6.1

Note: It should be noted that in the years 1986 to 1988, water restrictions applied. These restrictions are reflected in the average water consumption figures for the households.

Macro-Econometric Model Statistics

Coefficient of Determination R^2		0.904
Degrees of Freedom	v1	5
	v2	2
F Statistic	F-critical	19.3
	F-observed	3.78

Table 6.2 F and R^2 Statistics

Variable	t-observed value	From Statistical Table
Ave Water Price	-0.787	2.353
Rainfall	-0.991	
Water restrictions	-0.081	
Ave HH size	1.210	
Ave Income	-0.115	

Table 6.3 T Statistics

6.6 Conclusions

The results obtained from exercising the econometric model developed to estimate the price elasticity of demand for water at Alberton cannot readily be used for pricing policy formulation. This can be attributed mainly to the fact there was insufficient quality historical data available for use in the analysis. Complicating the issue further is the fact that the increases in the price of water did not have a significant effect on water usage patterns to impact the results obtained from the model. Price increases of water did not serve therefore to restrict white South African water consumers in the past as it was always readily available to them and the cost to them was relatively insignificant. This does not necessarily hold true for the future, as the same water resources now have to be available to all South Africans.

In Chapter One, it was stated that the approach for estimating the price elasticity of demand for water in the past has been dominated by econometric modelling; and that this approach usually involves regression analysis and is strongly dependent upon adequate historical data. Furthermore, as a motivating factor for undertaking this particular study, the hypothesis was put forward that such data in South Africa would not be sufficient to support a serious study on price elasticities of demand.

The inability to obtain the required historical data in order to determine the long-term or medium-term price elasticities of demand of water from the macro-econometric model suggests that this hypothesis is confirmed for Alberton.

Econometric modeling can be seen to be a mathematically more rigorous approach to obtaining price elasticities of demand than the CV approach which is based on hypothetical transactions in a simulated market for non-market goods and may be more readily defensible than conclusions drawn from CV analysis. Whilst such conclusions should then be regarded more tentatively, they do resent results that seem to generally agree with those obtained from econometric analysis.

CHAPTER 7 - SUMMARY AND RECOMMENDATIONS

7.1 Introduction

This chapter is divided into five sections in addition to this introduction. The first section contains a summary of the objectives and results of the two surveys undertaken in this study; the second section gives an overview of the conclusions which can be drawn from the results of the study; the third section demonstrates how this study can be of use to water resource planners and policy makers; the fourth section gives some final comments on water resources management; and the last section recommends future work which could be undertaken following this study.

7.2 Summary of Objectives and Results of the Study

This pilot study is essentially concerned with water pricing and people's behaviour as the price of water increases. The results of this study firstly established the residential water usage patterns in Alberton and Thokoza, and secondly, the price elasticities of demand for different income levels in this area. In order to achieve the objectives of the study, the approach consisted of a two-stage interview survey as follows:

- Survey No 1: A water usage profile survey.
- Survey No 2: A CV experiment and analysis.

The purpose of Survey No 1 was to establish detailed water use characteristics for the area chosen. This information was necessary in order to be able to undertake the second survey.

The purpose of Survey No 2 was to provide data on consumer responses contingent upon changing water supply conditions. In this survey, questions were posed which enabled the researchers to see how water-using behaviour varies with water tariff changes.

During these surveys, it was found that people were not aware of how they used water , nor were they aware of how they could save water. As a result, it was necessary to undertake an educational programme as part of the complete process in order to arrive at a meaningful result. Surveys 1 and 2 were therefore used in conjunction with each other, and the end result of the analysis yielded defensible estimates of the price elasticity of demand for domestic water usage amongst residential consumers in Alberton and Thokoza. The results obtained from the two surveys are summarised in Figure 7.1 and Table 7.1 below. Good comparisons for the price elasticity of demand for water were found with various other international studies. Because of the lack of historical data at Alberton, comparison could not readily be made between the econometric model and the CV experiment.

The question that can be asked is whether these results can be extrapolated and used in other areas in South Africa with some confidence? The answer to this question is that the results of this study can only reliably be used for other areas in South Africa provided the following points are considered:

- A socio-economic profile similar to that of Alberton must exist, i.e., educational level, income level, family size etc.
- The climatic conditions should also closely resemble that of Alberton, i.e., precipitation and temperature, etc.
- A culture similar to that of Alberton should exist.

Furthermore, as mentioned above, the results obtained are largely dependent on the implementation of an educational programme dealing with aspects of water usage, i.e. how water is used and knowledge of ways to save water. This is an essential requirement for any future work undertaken. Furthermore, this is also relevant when attempting to extrapolate these results for other areas in South Africa, as the behaviour of people as the price of water increases, will depend largely on their knowledge of water conservation issues gained from an educational programme.

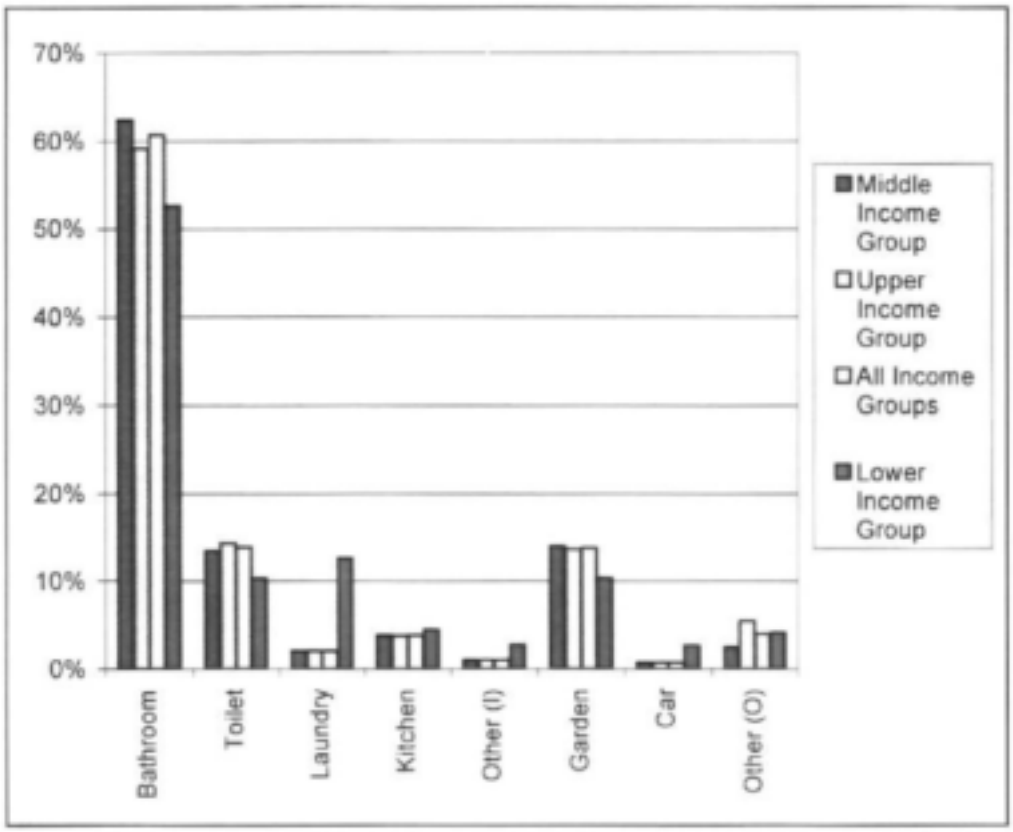


Figure 7.1 Perceived Profile of Monthly Water Usage

Description of group	No. of Respond.	Price Elasticity of Demand		
		Indoors	Outdoors	Total
Upper, middle and lower income groups	161	-0.13	-0.38	-0.17
Upper income group	52	-0.14	-0.47	-0.19
Middle income group	59	-0.12	-0.46	-0.17
Lower income group	50	-0.14	-0.19	-0.14
Upper and middle income groups	111	-0.13	-0.47	-0.18

Table 7.1 CV Results: Price Elasticity of Demand for Water

7.3 Summary of Conclusions

The conclusions, which have been drawn from the two surveys, are the following:

7.3.1 The Water Usage Profile Survey

From the perceived average monthly water usage per household in the different income groups in Alberton and Thokoza, there was a 40% increase in water usage in kilo-litres per month from the lowest income group (Thokoza) to the highest income group in Alberton. The difference within Alberton i.e. from the middle income group to the upper income group was approximately 22%.

From the perceived percentage water used indoors and outdoors for the different income groups in Alberton including Thokoza, it was seen that there was a remarkable similarity of indoor and outdoor water usage for all respondents to the survey. Specifically, the percentage usage in Thokoza is exactly the same as that for the middle income group in Alberton. It will be noted that respondents to the survey in the Alberton upper income group use a smaller percentage of water indoors (not in absolute terms), but a greater percentage of water outdoors, than the other respondents in the survey.

The two most important observations gleaned from the survey are the following:

(i) The higher income groups living in Alberton were less aware of the cost of water than the lower income group living in Thokoza.

(ii) The Thokoza residents involved in the study saw this survey as a good educational tool; they believed that being confronted with their actual water usage patterns aided them in learning how to manage water in a more efficient manner. They felt that such surveys should be widely undertaken.

7.3.2 CV Survey

From the CV experiment on the price elasticity of demand for water estimated for the various population and income groups in Alberton and Thokoza, the following important conclusions can be made:

(a) The outdoor price elasticities of demand are considerably more elastic than for indoor water usage for all cases.

(b) The following points can be gleaned from the price elasticities of demand determined for indoor water usage in the Upper (U) and Lower (L) income groups:

- The poor cannot afford to pay more as the price increases, indicating that their usage of water is for essential purposes rather than for luxury purposes e.g. use of a Jacuzzi, generous amount of water in baths, etc.; and
- The upper income group (U) has had a propensity to consume more water than other income groups, but increases in the price of water may encourage them to reduce water consumption in the short-term.

(c) The price elasticities of demand for total water usage in the different income groups demonstrate that as disposable income falls, less water is saved with a 100% price increase.

(d) As the price increases, there is a tendency of all income groups to reduce water usage.

(e) The Upper income group (U) has a propensity to use more water for outdoor usage than the other income groups.

(f) The lower income group (L), because of their limited disposable income, simply have to decrease their use of water as the price of water increases.

7.4 Use of the Study for Resource Planners and Policy Formulation

The results of this study can be of use to water resource planners and policy makers. In particular the study has shown that the price of water is an important consideration so far as domestic water consumption is concerned. Knowledge of water consumers' behaviour under changing price regimes is of great importance in formulating water policies and is essential for water planners when formulating demand side management strategies. Demand side management also helps in the conservation of water resources and in the improvement of the living environment by lowering volume and pollution loads of wastewater flows. Whilst the price elasticity of demand has been shown in this study to be inelastic in the short-term for all forms of domestic water usage, the price of water was nevertheless important, since it conditioned consumers' water usage behaviour. People of all income levels were shown to take cognisance of changes in the price of water and tended to reduce their water usage as the price of water increased. In quantitative terms, from the price elasticity of demand for total water usage in Alberton and Thokoza, for a 10% increase in the price of piped water for residential use, the water demand would be reduced by 1.7%. Such information can be used by both policy makers and water planners in cost benefit analysis for determining when or when not to build new water supply investments, e.g. instead of building a new dam or reservoir at some specified early date, price increases can be put in place to delay such an investment which in turn may free financial resources for other development activities such as the improving of water services to the poor.

Because price conditions how people use water, and how people use water conditions water policy formulation and water management strategies it is appropriate to briefly discuss some of the main issues that surround the structuring of water consumer tariffs.

7.4.1 Water Consumer Tariffs

Different pricing policies as reflected in the design of water tariffs have different effects on the demand (and allocation) of water, and the distribution of income.

Ideally tariffs should be simple enough in format for consumers to understand them and of course to react to them. The role of tariffs as signalling devices would be lost if they were complicated. Simplifying tariffs may not be easy, however, since in achieving tariffing goals there are complex problems to overcome for multi-product deliverables. In the case of water for example, the supplier is faced with pricing water for luxury purposes, water for industrial use and water for domestic use.

The recommendation that water tariffs should be related to the marginal cost supply sometimes found in the literature, is derived from economic models formulated in either general or partial equilibrium terms. It is noted, however, that prices for almost all commodities in the economy at large differ from marginal costs. Setting water tariffs to marginal costs poses difficult problems then and furthermore such tariffs may become difficult for consumers to understand as well.

Considerable debates also surrounds whether tariffs should be set to long or short-term costs. It can be argued that it is, whenever possible, preferable to set tariffs to the long-term. This is because frequent changes in the price of water i.e. changes in the short-term are expensive to administer. Furthermore, consumers take time to adjust to change and frequent changes can influence domestic expenditure patterns, especially amongst the poor. Prices set to long-term are also usually those required for consumers to make efficient investment decisions with respect to the provision of bore-holes or water saving devices etc. Having suggested that tariffs should be structured to satisfy long-term conditions, it is important to note that long-term inflation levels make such tariff structures difficult to design.

With respect to the structure of water tariffs, water tariffs in South Africa, are generally not divided into constituent parts of service delivery along the electricity model where the

charges for the delivery system and the energy charges are readily seen. It was noted above that tariffs should be easy to understand, if water tariffs were designed along the two-part electricity model this would enhance understanding and possibly make the consumer manage the demand-side of water management more efficiently.

Increasing block rate tariffs could also be investigated in South Africa as a tool in making demand-side management more amenable to water consumers. In the case of increasing block rates the impact of a price increase on the consumer can be divided into income and substitution effects. The income effect is a reduction in the level of real income resulting from a price increase, and causes a potential reduction in outlays for all goods and services. The substitution effects shows the extent to which the relatively now more expensive product is replaced in the consumer's total expenditure patterns by outlays for other goods and services. For example, an increase in water prices may induce some individuals to replace water-using lawns with gravel, bricks, and other paving materials. Higher water prices may also result in the use of more plumbing services (personal or professional) to repair leaky faucets and other water using equipment and to ensure that meters[1] are in working condition.

The use of increasing block rates should then theoretically facilitate more accurate predictions of consumer response to alterations in tariff structures because of the changing price elasticities of demand between blocks.

When considering the design of water tariff structures for the poor as a means of keeping the price of water low for these categories of consumers, cross-subsidisation is sometimes considered. When a tariff is subject to cross subsidisation however, certain problems of efficiency and equity are raised. For example, cross-subsidies can distort tariffs and negatively impact production costs in the industries that are responsible for providing the cross-subsidies, i.e., higher water costs to industries can detrimentally effect efficient

[1] In Thokoza, one of the comments voiced by many, highlighted the fact that meters were often badly installed and wrongly situated, and that most meters were leaking.

resource allocation. Cross-subsidies should then only be applied when fiscal policy is administratively unfeasible, which is not the case in South Africa.

In dealing with the poor who have difficulty in their ability to pay for water, it is therefore probably more advisable, and certainly a more appealing method of income distribution, to subsidise water supply above a certain subsistence level, which may be free, through fiscal policy. To allow low-income consumers to have access to more than subsistence levels of water, it is suggested that dedicated funds from the fiscus should be made available for this purpose.

An example of introducing a subsidised rate for water is in Chile. Chile adopted a direct subsidy policy in which the aim was to ensure that water services remain affordable to the urban poor without deteriorating the financial situation of the water companies. The subsidy is made available through the municipalities and financed by the Central Government budget. Chile introduced this targeted subsidy programme for water and sanitation services in 1991[2], with a view to reducing the burden of high water bills to those in need and to promote a healthy financial state of water utilities. The water subsidy covers both fixed and volumetric charges regardless of the total water consumption of the household and helps to pay for the first 15 kilolitres of water consumption and covers between 40 percent and 75 percent of the cost. An interesting feature of the system is that the subsidy decreases as the monthly consumption increases, and thereby engendering water conservation. The following examples show how the subsidy works:

Monthly Consumption	Subsidised Water Bill
15 kilo-litres	50%
20 kilo-litres	36%
30 kilo-litres	20%

[2] Source: "Nuevo Subsidio al Consumo de Agua Potable", Empresas de Servicios Sanitarios, Chile, April 1994.

A legitimate question that can be asked with respect to this study is whether the results obtained for Alberton and Thokoza can be extrapolated and used by policy makers and water planners in other areas in South Africa with confidence? The answer to this question is that the results of this study can only reliably be used for other areas in South Africa provided the following conditions apply:

- A socio-economic profile similar to that of Alberton must exist, i.e., educational level, income level, family size etc.
- The climatic conditions should also closely resemble that of Alberton, i.e., precipitation and temperature, etc.
- A culture similar to that of Alberton should exist.

The results obtained are also largely dependent on the implementation of an educational programme dealing with aspects of water usage, i.e. how water is used and knowledge of ways to save water. This then is relevant when attempting to extrapolate these results for other areas in South Africa, as the behaviour of people as the price of water increases, will depend largely on their knowledge of water conservation issues gained from an educational programme.

In addition to considering the water consumers problems, it is of course also imperative that the financial health of the water supplier is safeguarded, and this can also be achieved by tariff design, particularly where the supplier is not subsidised by the fiscus. The next section briefly discusses this issue.

7.4.2 Financial Health of Water Suppliers

In their efforts to remain in business as a service provider water suppliers, unless their costs are covered by government, have to formulate prices subject to certain constraints such as achieving preset financial targets, e.g., a minimum rate of return on investments.

Practically the imposition of the financial target should be related to the price elasticity of demand for water in the different water users domains, i.e., water for subsistence, luxury, etc. The financial targets should then ideally be related to the different products supplied by the water supplier and sensibly along the lines of common business practice be dependent on "what the market can bear".

The financial targets should theoretically then be higher for products that face relatively inelastic demands and lower for relatively elastic demand schedules. This can sometimes lead to equity problems, however, in the case of the poor.

For the health of the water suppliers it is important that financial returns of water suppliers must cover accounting costs including inflation, and be capable of financing future capital expenditure, at least in part. This requirement supports financial responsibility, mobilises financial resources for expansion and may enable management to engender an environment of innovation and efficiency. Enterprises that rely on having their deficits covered by the fiscus may be stymied so far as such goals are concerned.

7.5 Final Comments

This study has shown that water pricing is one of the most important economic instruments that does work for controlling consumers demand for water. Knowledge of people's behaviour under increasing price regimes is therefore an important piece of information for those charged with water policy formulation and water resource planners. CVM has been shown in this study to provide this information in a relatively simple way. As a result of the experience gained in this study it is also suggested that a very important consideration when selecting policy instruments for conserving and managing water efficiently, is the need to act at three levels of intervention for achieving these objectives ; these are

- Firstly, a set of national policies and strategies are needed at the macro-level, which set the basis within which the water supply and sanitation industry can operate;

- Secondly, a set of actions is required at the user's level. They can take two forms:

  (i) They may act as incentives for water users who can themselves determine the most efficient and cost-effective water usage patterns. Here Survey No. 1 in this study proved to be a useful guide to consumers for doing this; and

  (ii) They can be direct regulations that prohibit or limit excessive use of water along with monitoring and enforcement systems, i.e. command and control instruments;

- Thirdly, a set of actions is needed at the utility's level which can act as incentives to affect provider's behaviour on the way they manage the resource. Such actions would of course have to take cognisance of the utilities' economic welfare as commented upon in section 7.4.2 above.

The levels of intervention are not alternatives, but instead they reinforce each other. What is needed is a balance of the three layers to create a critical mass and synergy.

7.6 Future Work

In view of the different socio-economic profiles as well as climatic conditions existing in South Africa, it would be of benefit to undertake similar studies to this one in other cities in the country. Use of the experience gained in Alberton and Thokoza should be made in formulating these studies. In this pilot study, undertaken by EPE and discussed in this report, three particular variables only were considered for estimating consumer response for water price increases, however, these being the impact of family income, indoor and outdoor water use and the water price itself[3]. It is recommended that in future studies, the variables mentioned above should be increased in number and considered in greater depth. The following list suggets additional variables that should be considered:

[3] In addition, the respondents of the survey were involved in a partial education programme on how they use water and how water could be saved.

- Socio-economic variables of the household itself such as size, age of the members and ownership of the house.
- Characteristics of the residency such as population density, area of the lawn, availability of alternative water sources, age of the house, and water using fixtures;
- Climate conditions, e.g., temperature, precipitation and evapotranspiration rate;
- Water restrictions if any; and
- Type of water service, as measured in number of taps, water pressure, reliability, and water quality.
- In order to successfully undertake similar studies i.e., to estimate the price elasticity of demand for water, in other cities of South Africa, a far wider educational and conservation programme that was undertaken in this study is also recommended. Educational and conservation programmes are used to create awareness of water use and to encourage consumers to change their water consuing habits. Several examples of such a programme have been undertaken in different parts of the world, e.g., Bogor, Indonesia, Melbourne, Australia and Tucson, Arizona, cited in Yepes, Dianderas and Cestti (1995, pp. 45-46).

Expanding the number of variables analysed will provide policy makers and water resource planners with a greater understanding of the dynamics of domestic water usage and the factors that influence water users' behaviour under increasing price levels. This will allow policy formulation and water resource planning to be made with greater confidence in an ambiance of consumer participation.

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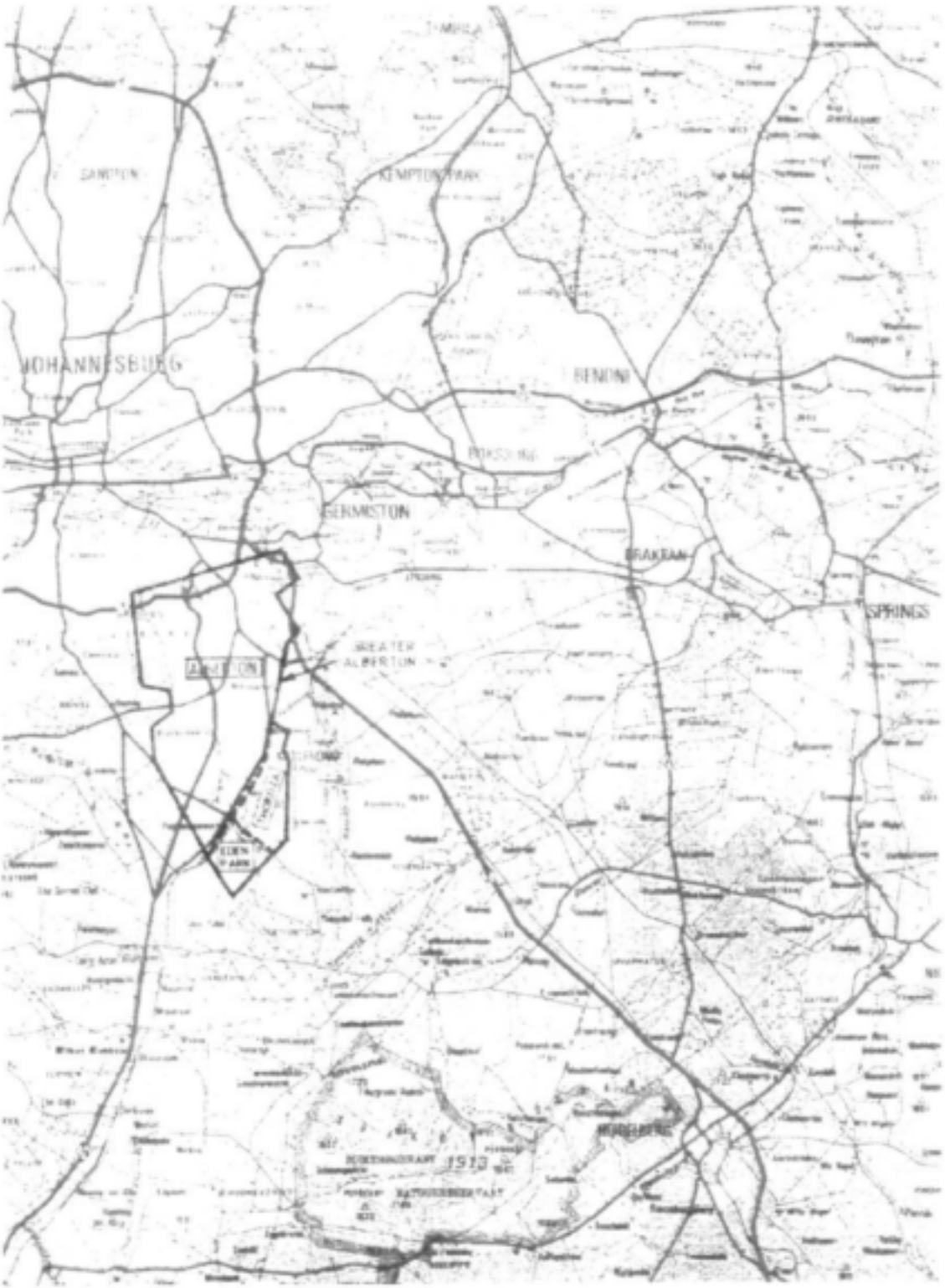
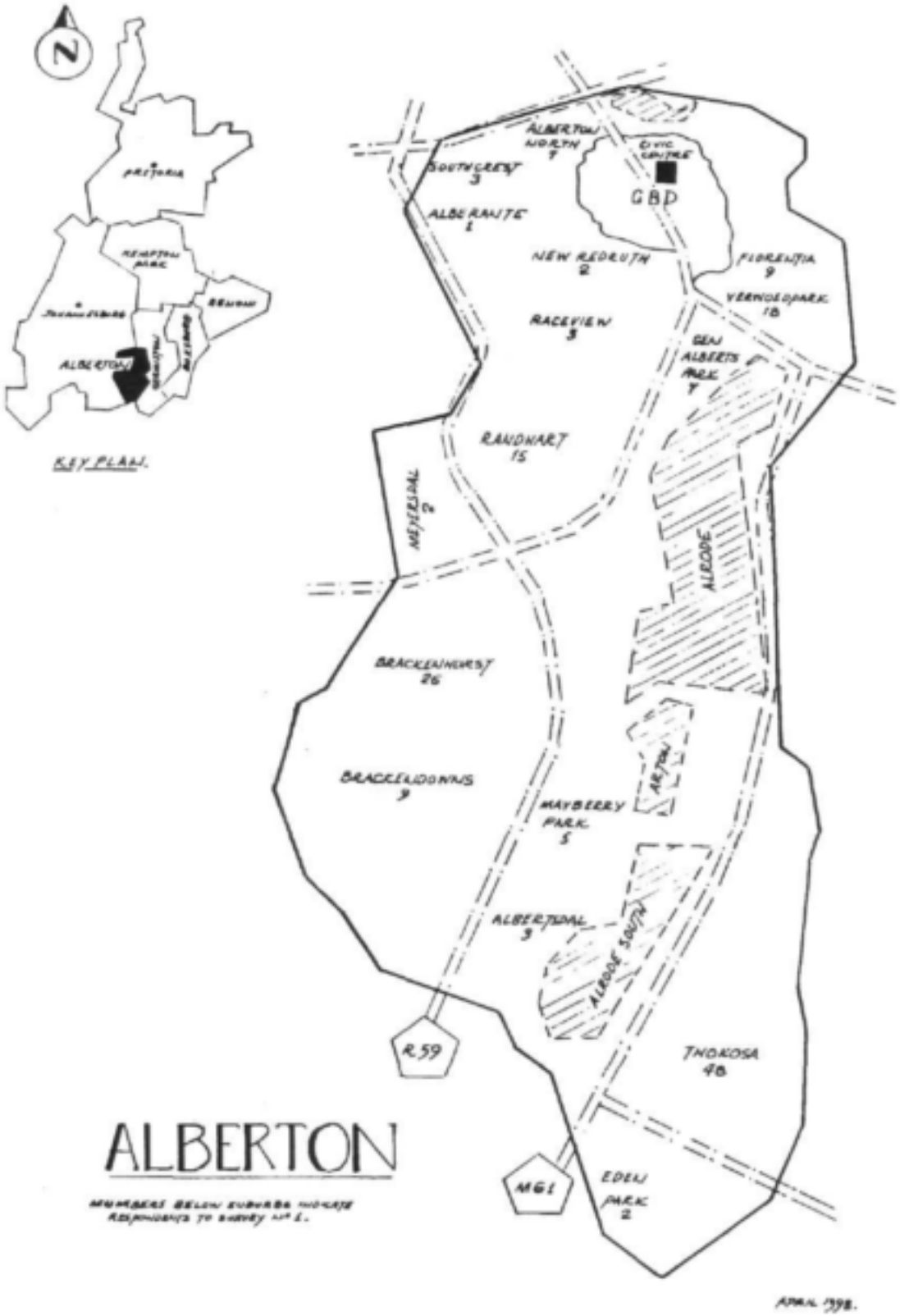
APPENDICES

APPENDIX A

Maps of Area Surveyed



Greater Alberton Locality Plan


N
PRETORIA
ALBERTON
KEY PLAN.
ALBERTON NORTH 7
CIVIC CENTRE
SOUTHCREST 3
GBD
ALBERAIITE 1
NEW REDRUTH 2
FLORENTIA 9
VERWOERDPARK 18
RACEVIEW 3
GEN ALBERTS PARK 7
RANDHART 15
HEIDELBERG ROAD 2
ALRODE
BRACKENHURST 26
BRACKENDOWNS 9
MAYBERRY PARK 5
ALBERTSDAL 3
ALRODE SOUTH
R.59
THOKOZA 48
MGL
EDEN PARK 2
ALBERTON
NUMBERS BELOW SUBURBS INDICATE RESPONDENTS TO SURVEY No 1.
APRIL 1998.

APPENDIX B

Water Usage Profile Survey Questionnaire for Alberton

Water Usage Profile Survey Questionnaire for Thokoza

WATER USAGE SURVEY No. 1

Water usage for selected households in Alberton. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	
Township name	
Erf number	
Address	
Date of interview	
Number of adults in household (including domestic servants)	
Number of children in household (under 18)	

Area	Description	How to measure the amount of water
	INDOOR USE	
Kitchen	Use of dishwasher Type:_____ Size:_____(litres)	Number of times per day
	Dishwashing by hand in sink*	¼ full,½ full, ¾ full,.and number of times per day
	Cooking	Number of cups of water per day
	Drinking	Number of cups of water per day
Bathroom	Bath	¼ full,½ full, ¾ full, and number of times per day
	Shower	Time in minutes and number of times per day
	Toilet flushing	Number of times per day
	Jacuzzi	¼ full,½ full, ¾ full, and number of times per day
Laundry & House Cleaning	Washing machine: Type:_____ Size: _____(litres):	Number of times per day
	Clothes washing by hand in sink*	¼ full,½ full, ¾ full,.and number of times per day
	Floors, windows etc.	Number of buckets per day
Other	Watering indoor pot plants	Number of buckets* per day
	Miscellaneous use to be detailed	As relevant.
	OUTDOOR USE	
Watering	Lawns	Time in minutes per day
	Vegetable garden	Time in minutes per day
	Fruit trees, flowers and shrubs	Time in minutes per day
Other	Car Washing	Number of buckets* per day and/or time in minutes (using hose pipe)
	Swimming Pool (Filling / topping up)	Time in minutes (using hose pipe)
	Outside cleaning: Paths, patios and driveways etc.	Number of buckets* per day and/or time in minutes (using hose pipe)
	Miscellaneous use to be detailed	As relevant.

NOTE: * if other please specify

Questionnaire for Week 1:

Water Consumption

Indoor Use	Day													
	8		9		10		11		12		13		14	
	No	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF
Using dishwasher														
Dishwashing by hand														
Cooking														
Drinking														
Bath														
Shower														
Toilet flushing														
Jacuzzi														
Washing machine														
Clothes – hand washing														
Floors and windows														
Watering indoor pot plants														
Miscellaneous														

Outdoor Use	Day													
	8		9		10		11		12		13		14	
	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF	No.	T/ HF
Lawns														
Vegetable garden														
Trees, flowers & shrubs														
Car washing														
Swimming pool														
Outside cleaning: patios etc														
Miscellaneous														

Note: ***No. = Number of times/ cups/ buckets per day***
T = Time in minutes
HF = How full i.e. ¼ full, ½ full, ¾ full or full

Questionnaire for Week 2:

Water Consumption														
Indoor Use	**Day**													
	8		**9**		**10**		**11**		**12**		**13**		**14**	
	No	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**
Using dishwasher														
Dishwashing by hand														
Cooking														
Drinking														
Bath														
Shower														
Toilet flushing														
Jacuzzi														
Washing machine														
Clothes – hand washing														
Floors and windows														
Watering indoor pot plants														
Miscellaneous														
Outdoor Use	**Day**													
	8		**9**		**10**		**11**		**12**		**13**		**14**	
	No.	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**	**No.**	**T/ HF**
Lawns														
Vegetable garden														
Trees, flowers & shrubs														
Car washing														
Swimming pool														
Outside cleaning: patios etc														
Miscellaneous														

Note: ***No. = Number of times/ cups/ buckets per day***
T = Time in minutes
HF = How full i.e. ¼ full, ½ full, ¾ full or full

BOREHOLE

1. **Do you have a borehole?** _____ **(Yes / No)**

2. **Capacity of borehole** _____ **(litres per hour)**

3. **How often is it used** _____ **(hours per month)**

4. **What is the water used for:**

   (a) Indoor use _____ **(hours per month)**

   (b) Outdoor use _____ **(hours per month)**

WATER USAGE SURVEY No. 1

Water usage for selected households in Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	
Township name	
Erf number	
Address	
Date of interview	
Number of adults in household (including domestic servants)	
Number of children in household (under 18)	

Water Consumption for Indoor Use

DAY	Cooking	Drinking	Bathing		Showering	Toilet Flushing	Washing Clothes in Bath		Washing Dishes & Pots in Sink		Washing Floors & Windows	Other Activities Specify:	
	No of Jugs/Pots	No of Jugs	No of Times	How Full	No of Times	No of Times	No of Times	How Full	No of Times	How Full	No of Buckets	No of Times	No of Buckets
Monday													
Tuesday													
Wednesday													
Thursday													
Friday													
Saturday													
Sunday													

Note: (1) The above information must include the water used by all the members of your household.

(2) Please estimate the average time per shower: _____ minutes.

Water Consumption for Outdoor Use

DAY	Watering the Garden		Washing Car		Outside Cleaning		Other Activities Specify:	
	Using hose pipe	Using buckets	Using hose pipe	Using buckets	Using hose pipe	Using buckets	Using hose pipe	Using buckets
	Time in minutes	No of buckets	Time in minutes	No of buckets	Time in minutes	No of buckets	Time in minutes	No of buckets
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								
Sunday								

APPENDIX C

Example of Results of Water Usage Profile Survey
in Alberton and Thokoza

Results of Survey No.1

General Information:

Name of Respondent:	Alberton # 1
Township:	Randhart
Erf number:	1630
Account number:	-
Number of persons:	5

Household Profile:

Water usage over 2 weeks		
Indoor usage:	**Litres**	**%**
Bathroom	5 310	49.5%
Toilet	1 053	9.8%
Laundry	323	3.0%
Kitchen	462	4.3%
Other	120	1.1%
Sub-Total	7 268	67.8%
Outdoor usage:		
Garden	3 240	30.2%
Car	0	0.0%
Other	217	2.0%
Sub-Total	3 457	32.2%
Total	10 725	100%

Summary of Results:

Average water usage per day	766	litres/day
Average water usage per month	23	klitres/month
Equivalent monthly bill	R 43.32	

Results of Survey No.1

General Information:

Name of Respondent:	Thokoza # 1
Township:	Ext 2 Thokoza
Erf number:	10760 (89)
Account number:	-
Number of persons:	2

Household Profile:

Water usage over 1 week		
Indoor usage:	**Litres**	**%**
Bathroom	938	44.6%
Toilet	90	4.3%
Laundry	540	25.7%
Kitchen	141	6.7%
Other	70	3.3%
Sub-Total	1 779	84.6%
Outdoor usage:		
Garden	324	15.4%
Car	0	0.0%
Other	0	0.0%
Sub-Total	324	15.4%
Total	2 103	100%

Summary of Results:

Average water usage per day	300	litres/day
Average water usage per month	9	klitres/month
Equivalent monthly bill	R 16.95	

APPENDIX D

Water Usage Profile Survey Database

Water Usage Profile Survey Database for Lower Income Group (L)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	Equivalent R
1	A100	EDEN PARK	6	2	15.5	67.9%	4.7	20.7%	0.7	3.0%	1.1	4.6%	0.6	2.7%	22.6	99.0%	0.0	0.0%	0.2	1.0%	0.0	0.0%	0.2	1.0%	23	R 43.32
2	A110	EDEN PARK	7	2	20.5	76.3%	4.5	16.6%	0.7	2.5%	0.8	2.9%	0.4	1.5%	26.8	100%	0.0	0.0%	0.1	0.3%	0.0	0.0%	0.1	0.3%	27	R 50.85
3	T01	Thokoza	2	0	4.1	44.6%	0.4	4.3%	2.3	25.7%	0.6	6.7%	0.3	3.3%	7.7	84.6%	1.4	15.4%	0.0	0.0%	0.0	0.0%	1.4	15.4%	9	R 16.95
4	T02	Thokoza	3	1	8.7	62.7%	1.8	12.9%	1.6	11.2%	0.8	6.0%	0.3	2.2%	13.2	95.0%	0.4	2.8%	0.0	0.0%	0.3	2.2%	0.7	5.0%	14	R 26.37
5	T03	Thokoza	8	3	28.3	79.2%	2.2	6.2%	0.2	0.5%	0.8	2.2%	0.0	0.0%	31.5	88.2%	2.4	6.8%	0.0	0.0%	1.8	5.0%	4.2	11.8%	36	R 73.93
6	T04	Thokoza	14	6	4.6	17.3%	0.9	3.5%	19.4	72.6%	0.8	2.9%	0.1	0.3%	25.8	96.6%	0.4	1.5%	0.5	1.9%	0.0	0.0%	0.9	3.4%	27	R 50.85
7	T05	Thokoza	9	4	15.5	51.8%	2.3	7.7%	7.3	24.4%	1.1	3.7%	0.6	2.0%	26.8	89.7%	0.4	1.4%	1.4	4.6%	1.3	4.3%	3.1	10.3%	30	R 56.50
8	T06	Thokoza	7	3	2.6	38.7%	2.3	34.7%	1.0	15.7%	0.5	7.7%	0.2	3.3%	6.7	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	7	R 13.18
9	T07	Thokoza	5	3	8.4	53.4%	2.9	18.7%	1.6	10.0%	0.6	4.1%	0.2	1.1%	13.7	87.3%	1.3	8.2%	0.0	0.0%	0.7	4.5%	2.0	12.7%	16	R 30.13
10	T08	Thokoza	7	4	17.9	76.7%	2.2	9.5%	0.9	3.7%	0.8	3.2%	0.2	0.9%	22.0	94.1%	1.0	4.2%	0.0	0.0%	0.4	1.7%	1.4	5.9%	23	R 43.32
11	T09	Thokoza	8	2	30.9	83.0%	2.1	5.7%	0.8	2.1%	0.9	2.4%	0.0	0.0%	34.7	93.2%	1.6	4.4%	0.0	0.0%	0.9	2.4%	2.5	6.8%	37	R 76.84
12	T10	Thokoza	8	3	29.1	75.4%	2.4	6.2%	1.1	8.1%	0.9	2.3%	0.0	0.0%	35.5	92.0%	1.9	5.0%	0.0	0.0%	1.2	3.0%	3.1	8.0%	39	R 82.65
13	T11	Thokoza	11	1	4.8	34.8%	2.3	16.5%	1.3	9.5%	0.7	4.9%	0.0	0.0%	9.0	65.8%	4.7	34.2%	0.0	0.0%	0.0	0.0%	4.7	34.2%	14	R 26.37
14	T12	Thokoza	6	2	22.8	80.5%	2.5	8.7%	2.1	7.4%	0.8	2.9%	0.2	0.6%	28.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	28	R 52.74
15	T13	Thokoza	4	2	1.7	18.4%	1.8	20.3%	2.5	27.4%	1.4	15.2%	0.3	3.4%	7.6	84.6%	1.0	11.1%	0.0	0.0%	0.4	4.3%	1.4	15.4%	9	R 16.95
16	T14	Thokoza	6	2	13.7	72.8%	2.0	10.6%	2.1	11.0%	0.7	3.6%	0.0	0.0%	18.5	97.9%	0.2	0.9%	0.0	0.0%	0.2	1.2%	0.4	2.1%	19	R 35.78
17	T15	Thokoza	7	3	3.9	40.7%	2.3	24.3%	0.4	4.1%	0.9	9.1%	0.5	5.4%	8.1	83.6%	1.4	15.0%	0.0	0.0%	0.1	1.4%	1.6	16.4%	10	R 18.83
18	T16	Thokoza	6	4	2.7	14.0%	0.5	2.8%	6.3	32.3%	0.4	2.1%	5.7	29.4%	15.6	80.7%	2.0	10.1%	0.7	3.4%	1.1	5.8%	3.7	19.3%	19	R 35.78
19	T17	Thokoza	6	1	2.3	13.9%	3.9	23.0%	1.3	7.8%	0.5	2.8%	1.5	9.1%	9.5	56.5%	6.5	38.5%	0.4	2.6%	0.4	2.3%	7.3	43.5%	17	R 32.02
20	T18	Thokoza	4	2	10.1	45.1%	1.9	8.4%	2.1	9.3%	0.8	3.5%	0.2	0.7%	15.0	66.9%	1.3	5.6%	4.2	18.7%	2.0	8.9%	7.4	33.1%	22	R 41.43
21	T19	Thokoza	10	4	10.5	68.6%	2.1	13.8%	1.6	10.2%	0.7	4.4%	0.2	1.4%	15.0	98.5%	0.2	1.3%	0.0	0.0%	0.0	0.3%	0.2	1.5%	15	R 28.25
22	T20	Thokoza	3	0	17.8	32.6%	3.1	5.6%	4.7	8.6%	1.4	2.5%	9.3	17.0%	36.3	66.3%	3.9	7.1%	4.2	7.7%	10.3	18.9%	18.5	33.7%	55	R 129.13
23	T21	Thokoza	11	5	16.5	36.8%	3.2	7.3%	4.2	9.3%	1.2	2.7%	0.8	1.8%	25.9	57.9%	13.4	30.0%	3.2	7.1%	2.2	5.0%	18.8	42.1%	45	R 100.08
24	T22	Thokoza	9	5	14.2	61.2%	1.7	7.3%	4.2	18.0%	1.0	4.3%	0.1	0.4%	21.1	91.2%	1.6	6.8%	0.0	0.0%	0.5	2.1%	2.0	8.8%	23	R 43.32
25	T23	Thokoza	5	2	17.8	67.3%	2.5	9.5%	3.1	11.8%	0.8	2.9%	0.0	0.0%	24.2	91.5%	1.3	5.1%	0.0	0.0%	0.9	3.4%	2.2	8.5%	26	R 48.97
26	T24	Thokoza	5	3	15.6	62.6%	1.0	4.1%	3.7	14.6%	0.9	3.5%	0.0	0.0%	21.2	84.7%	2.0	8.0%	0.5	1.8%	1.3	5.4%	3.8	15.3%	25	R 47.09
27	T25	Thokoza	2	1	1.2	9.0%	1.0	7.7%	3.5	26.2%	0.8	6.0%	0.2	1.6%	6.7	50.5%	5.9	44.3%	0.0	0.0%	0.7	5.2%	6.6	49.5%	13	R 24.48
28	T26	Thokoza	7	4	14.8	66.0%	1.0	4.5%	4.2	18.6%	0.8	3.7%	0.4	1.7%	21.2	94.6%	0.4	1.6%	0.4	1.6%	0.5	2.1%	1.2	5.4%	22	R 41.43
29	T27	Thokoza	4	2	5.0	28.5%	1.1	6.2%	3.1	17.9%	1.7	9.6%	0.6	3.1%	11.5	65.3%	4.9	27.8%	0.0	0.0%	1.2	6.9%	6.1	34.7%	18	R 33.90
30	T28	Thokoza	6	3	15.4	76.4%	2.0	9.9%	1.0	5.2%	1.1	5.5%	0.3	1.5%	19.9	98.5%	0.0	0.0%	0.0	0.0%	0.3	1.5%	0.3	1.5%	20	R 37.67
31	T29	Thokoza	6	2	16.9	67.7%	2.4	9.5%	1.6	6.3%	1.3	5.2%	0.0	0.0%	22.2	88.7%	0.9	3.5%	0.6	2.3%	1.4	5.6%	2.8	11.3%	25	R 47.09
32	T30	Thokoza	7	4	25.4	76.1%	3.3	9.9%	1.6	4.7%	1.0	2.9%	0.2	0.7%	31.4	94.3%	1.2	3.7%	0.0	0.0%	0.7	2.0%	1.9	5.7%	33	R 65.22
33	T31	Thokoza	4	3	12.7	51.7%	2.5	10.2%	1.6	6.3%	1.8	7.1%	0.2	0.9%	18.8	76.2%	5.9	23.8%	0.0	0.0%	0.0	0.0%	5.9	23.8%	25	R 47.09
34	T32	Thokoza	5	2	16.2	72.1%	3.0	13.4%	1.6	7.0%	0.8	3.4%	0.1	0.3%	21.6	96.2%	0.8	3.5%	0.0	0.0%	0.1	0.3%	0.8	3.8%	22	R 41.43
35	T33	Thokoza	6	4	6.0	51.0%	0.4	3.3%	1.6	13.4%	0.2	1.9%	0.5	4.5%	8.7	74.0%	2.2	18.4%	0.8	7.0%	0.1	0.7%	3.0	26.0%	12	R 22.60
36	T34	Thokoza	14	0	11.5	35.6%	3.7	11.5%	1.0	3.0%	2.1	6.5%	0.9	2.7%	19.1	59.3%	10.6	32.7%	2.5	7.7%	0.1	0.3%	13.1	40.7%	32	R 62.31
37	T35	Thokoza	4	2	4.0	52.8%	0.4	5.7%	1.0	13.8%	0.2	2.4%	0.3	4.0%	5.9	78.7%	1.7	15.6%	0.0	0.0%	0.4	5.7%	1.6	21.3%	8	R 15.07
38	T36	Thokoza	6	3	9.9	70.2%	1.9	13.3%	1.0	7.4%	0.7	4.8%	0.3	2.2%	13.8	97.8%	0.0	0.0%	0.0	0.0%	0.3	2.2%	0.3	2.2%	14	R 26.37
39	T37	Thokoza	10	6	5.8	31.4%	2.2	11.9%	2.1	11.3%	0.6	3.2%	0.3	1.7%	11.0	59.5%	5.9	32.2%	0.6	3.3%	0.9	5.0%	7.5	40.5%	18	R 33.90
40	T38	Thokoza	8	5	11.9	30.7%	2.5	6.4%	10.2	26.3%	3.1	8.1%	0.7	1.8%	28.3	73.2%	3.9	10.1%	3.5	9.0%	3.0	7.7%	10.4	26.8%	39	R 82.65
41	T40	Thokoza	12	7	3.9	52.1%	2.7	35.5%	0.1	1.7%	0.8	10.6%	0.0	0.0%	7.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	7	R 13.18
42	T41	Thokoza	5	3	16.2	74.8%	2.4	11.2%	1.6	7.2%	1.2	5.4%	0.2	0.8%	21.5	99.4%	0.0	0.0%	0.0	0.0%	0.1	0.6%	0.1	0.6%	22	R 41.43
43	T42	Thokoza	3	0	1.6	47.0%	0.8	24.9%	0.3	7.9%	0.4	12.0%	0.2	4.6%	3.2	96.3%	0.0	1.3%	0.0	0.0%	0.1	2.4%	0.1	3.7%	3	R 5.65
44	T43	Thokoza	4	2	1.3	37.4%	1.9	54.9%	0.0	0.0%	0.2	6.4%	0.0	1.3%	3.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	3	R 5.65
45	T44	Thokoza	8	4	5.9	33.5%	3.5	20.1%	3.1	17.9%	1.0	5.8%	0.2	0.9%	13.7	78.2%	3.5	20.1%	0.0	0.0%	0.3	1.7%	3.8	21.8%	18	R 33.90
46	T45	Thokoza	7	3	2.2	48.3%	1.4	30.6%	0.1	2.9%	0.8	18.2%	0.0	0.0%	4.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	4	R 7.53
47	T46	Thokoza	6	2	2.1	19.2%	2.2	20.3%	2.1	19.0%	0.7	6.8%	0.1	0.8%	7.2	66.1%	1.4	12.5%	2.3	21.4%	0.0	0.0%	3.7	33.9%	11	R 20.72
48	T47	Thokoza	7	3	2.6	32.3%	2.7	32.9%	0.2	2.0%	0.7	8.6%	0.1	1.1%	6.3	76.9%	0.0	0.0%	0.0	0.0%	1.9	23.1%	1.9	23.1%	8	R 15.07
49	T48	Thokoza	8	3	3.1	38.6%	2.5	31.9%	0.2	2.5%	0.7	9.0%	0.0	0.0%	6.5	82.0%	0.0	0.0%	0.0	0.0%	1.4	18.0%	1.4	18.0%	8	R 15.07
50	T49	Thokoza	2	0	7.7	21.8%	1.1	3.1%	16.4	46.2%	1.6	4.4%	0.2	0.4%	27.0	75.9%	0.8	2.2%	3.9	11.0%	3.9	10.9%	8.6	24.1%	36	R 71.03

Table D.1

Water Usage Profile Survey Database for Middle Income Group (M)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	Equivalent R@
1	A002	MAYBERRY PARK	5	2	32.4	78.7%	5.5	13.3%	0.8	2.0%	0.9	2.1%	0.9	2.2%	40.5	98.3%	0.3	0.7%	0.0	0.0%	0.4	1.0%	0.7	1.7%	41.2	R 88.46
2	A003	ALBERTON NORTH	5	0	26.0	71.4%	2.7	7.5%	0.9	2.6%	2.3	6.4%	0.1	0.2%	32.0	88.1%	3.7	10.2%	0.6	1.6%	0.0	0.0%	4.3	11.9%	36.4	R 73.93
3	A004	FLORENTIA	3	0	13.4	75.6%	1.6	9.1%	0.2	1.4%	0.9	6.0%	0.1	0.4%	13.9	92.4%	0.4	2.6%	0.0	0.3%	0.7	4.7%	1.1	7.6%	15.1	R 28.25
4	A005	ALBERTON NOORD	5	1	14.1	65.5%	5.5	25.4%	0.9	4.3%	0.7	3.3%	0.1	0.2%	21.3	98.7%	0.0	0.0%	0.0	0.1%	0.3	1.2%	0.3	1.3%	21.6	R 41.43
5	A006	ALBERTON NORTH	6	2	19.2	70.3%	3.9	14.2%	0.5	1.9%	1.0	3.7%	0.0	0.1%	24.6	90.2%	2.3	8.6%	0.3	1.1%	0.0	0.1%	2.7	9.8%	27.3	R 50.85
6	A007	ALBERTON NORTH	3	1	13.2	57.7%	1.9	8.4%	0.7	2.9%	0.6	2.5%	0.0	0.2%	16.4	71.7%	4.7	20.5%	0.0	0.2%	1.8	7.7%	6.5	28.3%	22.9	R 41.32
7	A008	ALBERTSDAL	1	0	5.0	62.5%	0.7	8.3%	0.5	6.1%	0.6	7.2%	0.5	6.0%	7.2	90.0%	0.8	9.7%	0.0	0.2%	0.0	0.0%	0.8	10.0%	8.0	R 15.07
8	A009	ALBERTSDAL	2	0	5.6	49.4%	3.8	33.1%	0.3	2.5%	0.8	7.2%	0.2	1.5%	10.6	93.7%	0.6	5.2%	0.1	0.9%	0.0	0.3%	0.7	6.3%	11.3	R 20.72
9	A012	ALBERTSDAL	4	0	16.4	65.3%	4.5	17.9%	0.8	3.2%	1.5	6.0%	0.4	1.4%	23.6	93.8%	0.4	1.6%	0.0	0.0%	1.2	4.7%	1.6	6.2%	25.2	R 47.09
10	A039	FLORENTIA	3	0	9.8	64.1%	2.5	16.6%	0.1	0.5%	0.5	3.2%	0.0	0.2%	13.0	84.5%	1.8	11.5%	0.0	0.0%	0.6	4.1%	2.4	15.5%	15.4	R 28.25
11	A040	FLORENTIA	3	0	10.2	51.7%	3.2	16.5%	0.4	2.0%	0.7	3.6%	0.0	0.1%	14.6	73.8%	4.7	23.8%	0.1	0.3%	0.4	2.1%	5.2	26.2%	19.7	R 37.67
12	A041	FLORENTIA	3	0	7.8	52.5%	3.3	22.2%	0.2	1.5%	0.5	3.5%	0.2	1.1%	12.0	80.8%	2.3	15.9%	0.5	3.2%	0.0	0.1%	2.8	19.2%	14.8	R 28.25
13	A042	FLORENTIA	2	0	7.6	57.6%	2.2	16.6%	0.2	1.2%	0.7	5.0%	0.0	0.4%	10.7	81.3%	2.3	17.8%	0.1	0.7%	0.0	0.1%	2.5	18.7%	13.2	R 24.48
14	A043	FLORENTIA	4	1	12.8	69.2%	2.7	14.8%	0.8	4.4%	0.4	2.3%	0.1	0.4%	16.8	91.2%	1.2	6.4%	0.0	0.0%	0.4	2.4%	1.6	8.8%	18.5	R 33.90
15	A044	FLORENTIA	2	0	8.4	63.8%	2.0	14.9%	0.3	2.0%	1.0	7.5%	0.2	1.2%	11.8	89.4%	1.2	8.9%	0.1	0.9%	0.1	0.8%	1.4	10.6%	13.2	R 24.48
16	A045	GEN ALBERTSPARK	4	0	15.7	67.0%	3.1	13.3%	0.4	1.6%	0.4	1.6%	0.1	0.3%	19.6	83.8%	3.7	15.8%	0.0	0.1%	0.1	0.3%	3.8	16.2%	23.4	R 43.32
17	A046	GENL ALBERTSPARK	5	0	17.8	77.8%	3.5	15.1%	0.1	0.4%	0.6	2.7%	0.0	0.1%	22.0	96.1%	0.6	2.6%	0.1	0.6%	0.2	0.8%	0.9	3.9%	22.9	R 43.32
18	A047	MAYBERRY PARK	7	5	51.4	80.8%	5.5	8.6%	0.3	0.5%	0.7	1.1%	0.1	0.1%	58.0	91.1%	4.7	7.4%	1.0	1.5%	0.0	0.0%	5.7	8.9%	63.7	R 155.28
19	A048	MAYBERRY PARK	3	2	9.6	45.7%	4.4	21.0%	0.3	1.3%	0.4	2.0%	0.0	0.2%	14.7	70.3%	3.5	16.8%	0.0	0.2%	2.7	12.7%	6.2	29.7%	21.0	R 39.55
20	A049	MAYBERRY PARK	4	1	17.9	65.6%	2.5	9.0%	0.9	3.4%	1.1	4.0%	0.8	2.9%	23.2	84.9%	2.2	7.9%	0.3	1.0%	1.7	6.3%	4.1	15.1%	27.3	R 50.85
21	A050	MAYBERRY PARK	6	4	26.9	87.4%	1.6	5.3%	0.8	2.6%	1.2	3.8%	0.2	0.6%	30.7	99.8%	0.0	0.0%	0.0	0.0%	0.1	0.2%	0.1	0.2%	30.7	R 59.41
22	A051	RACEVIEW	3	0	15.4	74.5%	2.0	9.6%	0.1	0.6%	1.9	9.3%	0.1	0.3%	19.5	94.2%	1.2	5.7%	0.0	0.1%	0.0	0.0%	1.2	5.8%	20.7	R 39.55
23	A052	RACEVIEW	2	0	5.2	36.1%	4.1	28.7%	0.0	0.2%	0.6	4.5%	0.1	0.5%	10.0	70.0%	4.1	28.7%	0.0	0.1%	0.2	1.1%	4.3	30.0%	14.3	R 26.37
24	A065	SOUTH CREST	2	0	5.3	67.0%	0.8	10.3%	0.0	0.4%	0.6	7.6%	0.0	0.5%	6.9	85.8%	1.1	13.6%	0.0	0.5%	0.0	0.0%	1.1	14.2%	8.0	R 15.07
25	A066	SOUTH CREST	2	0	6.0	52.8%	2.0	17.4%	0.4	3.6%	1.1	9.3%	0.1	0.5%	9.5	83.4%	0.0	0.0%	1.8	15.4%	0.1	1.2%	1.9	16.6%	11.4	R 20.72
26	A067	SOUTHCREST	2	0	8.3	28.8%	2.9	9.9%	0.0	1.5%	1.2	4.1%	0.0	0.1%	12.4	44.3%	15.8	54.3%	0.2	0.7%	0.1	0.2%	16.1	55.7%	28.5	R 54.62
27	A068	VERWOERDPARK	4	0	32.9	82.7%	3.6	9.1%	0.4	1.0%	1.0	2.5%	0.4	1.0%	38.2	96.3%	0.6	1.5%	0.0	0.0%	0.9	2.2%	1.5	3.7%	39.7	R 85.56
28	A069	VERWOERDPARK	2	0	6.4	35.3%	1.1	6.1%	0.1	0.4%	0.6	3.5%	0.2	0.9%	8.3	46.1%	9.4	51.9%	0.0	0.0%	0.3	1.9%	9.7	53.9%	18.1	R 33.90
29	A070	VERWOERDPARK	2	0	8.4	68.5%	1.2	9.5%	0.2	1.3%	0.6	4.6%	0.2	1.8%	10.6	85.7%	1.8	14.3%	0.0	0.0%	0.0	0.0%	1.8	14.3%	12.3	R 22.65
30	A071	VERWOERDPARK	2	0	4.6	42.1%	2.9	26.3%	0.3	2.6%	1.2	10.8%	0.0	0.3%	8.9	82.1%	0.8	7.2%	0.1	0.8%	1.1	9.9%	1.9	17.9%	10.8	R 20.72
31	A072	VERWOERDPARK	4	2	21.1	75.0%	2.7	9.7%	0.4	1.3%	0.6	2.3%	0.1	0.5%	25.0	88.7%	2.3	8.3%	0.2	0.8%	0.6	2.2%	3.2	11.3%	28.2	R 52.74
32	A073	VERWOERDPARK	3	0	14.2	73.4%	1.8	9.3%	0.3	1.7%	1.1	5.7%	0.2	0.8%	17.6	90.9%	0.0	0.0%	0.0	0.0%	1.8	9.1%	1.8	9.1%	19.3	R 35.78
33	A074	VERWOERDPARK	4	2	20.1	78.5%	2.4	9.5%	0.6	2.2%	1.2	4.9%	0.3	1.3%	24.6	96.4%	0.6	2.3%	0.3	1.1%	0.1	0.2%	0.9	3.6%	25.6	R 48.97
34	A075	VERWOERDPARK	3	0	5.6	15.9%	3.3	9.3%	0.7	1.9%	0.9	2.5%	0.2	0.5%	10.7	30.1%	24.6	69.5%	0.0	0.0%	0.1	0.3%	24.8	69.9%	35.4	R 71.03
35	A076	VERWOERDPARK	3	0	11.9	64.1%	4.1	22.2%	0.8	4.5%	1.2	6.6%	0.1	0.6%	18.2	98.0%	0.2	1.2%	0.2	0.9%	0.0	0.0%	0.4	2.0%	18.5	R 35.78
36	A077	VERWOERDPARK	4	1	25.6	45.8%	5.5	9.8%	0.9	1.7%	2.4	4.3%	0.2	0.4%	34.6	62.0%	18.8	33.7%	0.0	0.0%	2.4	4.3%	21.2	38.0%	55.8	R 132.04
37	A078	VERWOERDPARK	3	1	9.6	55.6%	2.3	13.3%	0.1	0.8%	1.2	6.9%	0.2	1.1%	13.4	77.7%	0.0	0.0%	0.2	1.3%	3.6	21.1%	3.8	22.3%	17.2	R 32.02
38	A079	VERWOERDPARK	2	0	6.4	50.7%	2.2	17.4%	0.2	1.7%	0.3	2.2%	0.1	0.9%	9.2	73.0%	2.9	23.3%	0.1	1.0%	0.3	2.8%	3.4	27.0%	12.6	R 24.48
39	A080	VERWOERDPARK	5	0	17.8	69.4%	3.9	15.3%	0.2	0.8%	0.9	3.5%	0.1	0.5%	22.9	89.5%	2.3	9.2%	0.2	1.1%	0.1	0.2%	2.7	10.5%	25.6	R 48.97
40	A081	VERWOERDPARK	5	3	14.1	70.1%	3.1	15.5%	0.3	1.4%	0.6	3.0%	0.1	0.7%	18.3	90.7%	0.0	0.0%	0.1	0.4%	1.8	8.9%	1.9	9.3%	20.2	R 37.67
41	A082	VERWOERDPARK	4	1	16.4	77.3%	2.6	12.2%	0.1	0.4%	0.8	3.7%	0.0	0.1%	19.9	93.8%	0.0	0.0%	0.0	0.0%	1.3	6.2%	1.3	6.2%	21.2	R 39.55
42	A084	VERWOERDPARK	4	0	27.7	71.8%	2.4	7.2%	0.4	1.1%	0.9	2.8%	0.4	1.1%	27.8	84.1%	2.8	8.3%	0.0	0.0%	2.5	7.6%	5.3	15.9%	33.0	R 65.22
43	A085	FLORENTIA	4	0	15.6	61.9%	4.4	17.3%	0.5	1.8%	2.0	7.9%	0.3	1.1%	22.7	89.9%	0.2	0.8%	0.4	1.7%	1.9	7.6%	2.5	10.1%	25.3	R 47.09
44	A086	VERWOERDPARK	4	1	16.4	79.0%	2.7	13.2%	0.7	3.5%	0.4	2.0%	0.3	1.7%	20.7	99.4%	0.0	0.0%	0.0	0.0%	0.1	0.6%	0.1	0.6%	20.8	R 39.55
45	A087	NEW REDRUTH	7	3	22.0	66.4%	4.4	13.2%	1.5	4.4%	0.5	1.6%	0.1	0.5%	28.4	85.8%	4.7	14.2%	0.0	0.0%	0.0	0.0%	4.7	14.2%	33.1	R 65.22
46	A088	FLORENTIA	4	1	16.4	51.0%	2.7	8.5%	0.7	2.2%	1.9	5.9%	1.8	5.7%	23.6	73.3%	8.2	25.5%	0.2	0.6%	0.2	0.6%	8.6	26.7%	32.2	R 62.31
47	A089		2	0	12.5	59.3%	2.9	13.6%	0.1	0.4%	0.8	3.9%	0.2	0.8%	16.5	78.0%	4.3	20.4%	0.3	1.3%	0.1	0.3%	4.6	22.0%	21.1	R 39.55
48	A094	ALBERTON NORTH	2	1	4.6	71.0%	1.7	18.2%	0.1	0.8%	0.5	8.3%	0.1	1.7%	6.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	6.4	R 11.30
49	A095	GENL ALBERTSPARK	5	2	14.1	79.4%	2.2	12.3%	0.4	2.3%	0.7	3.8%	0.2	0.9%	17.6	98.7%	0.0	0.0%	0.2	1.3%	0.0	0.0%	0.2	1.3%	17.8	R 33.90
50	A096	VERWOERDPARK	4	1	12.8	70.6%	2.2	12.1%	0.4	2.3%	1.4	7.7%	0.6	3.4%	17.4	96.1%	0.6	3.2%	0.1	0.7%	0.0	0.0%	0.7	3.9%	18.1	R 33.90
51	A101	FLORENTIA	5	0	13.2	56.3%	5.2	22.0%	0.5	2.1%	0.9	3.9%	0.1	0.4%	19.9	84.7%	2.3	10.0%	1.2	5.2%	0.0	0.1%	3.6	15.3%	23.4	R 43.32
52	A102	GENL ALBERTSPARK	2	0	12.8	71.8%	3.3	18.5%	0.4	2.1%	0.8	4.7%	0.0	0.3%	17.3	97.4%	0.4	2.2%	0.0	0.2%	0.0	0.1%	0.5	2.6%	17.8	R 33.90
53	A103	GENL ALBERTSPARK	4	1	21.9	72.6%	5.5	18.2%	1.5	4.8%	1.0	3.4%	0.3	1.0%	30.2	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	30.2	R 56.50
54	A104	GENL ALBERTSPARK	2	0	10.0	73.0%	2.2	15.9%	0.4	2.8%	0.8	6.2%	0.1	0.9%	13.6	98.9%	0.0	0.0%	0.0	0.0%	0.2	1.1%	0.2	1.1%	13.7	R 26.37
55	A105	GENL ALBERTS PARK	5	2	10.0	60.1%	5.6	33.7%	0.5	2.9%	0.3	1.9%	0.0	0.0%	16.5	98.6%	0.0	0.0%	0.2	1.4%	0.0	0.0%	0.2	1.4%	16.7	R 32.02
56	A106	RACEVIEW	4	2	9.4	45.6%	2.8	13.5%	0.6	2.7%	0.5	2.7%	0.2	0.9%	13.5	65.4%	7.0	34.3%	0.1	0.4%	0.0	0.0%	7.1	34.6%	20.6	R 39.55
57	A108	VERWOERDPARK	7	3	15.1	59.1%	5.0	19.7%	0.5	1.9%	0.5	1.9%	0.2	0.9%	21.3	83.6%	3.9	15.3%	0.3	1.0%	0.0	0.0%	4.2	16.4%	25.5	R 47.09
58	A109	ALBERTON NORTH	6	2	17.9	28.1%	4.4	7.0%	0.6	0.9%	1.0	1.5%	1.8	2.9%	25.6	40.4%	32.9	51.8%	0.2	0.3%	4.7	7.5%	37.8	59.6%	63.5	R 152.38
59	A111	NEW REDRUTH	2	0	8.1	48.1%	2.2	13.0%	1.6	9.3%	0.8	4.7%	0.3	1.5%	12.9	76.7%	3.7	22.1%	0.0	0.0%	0.3	1.3%	3.9	23.3%	16.8	R 32.02

Table D.2

Water Usage Profile Survey Database for Upper Income Group (U)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	%	kl.	Equivalent Bill
1	A001	RANDHART	5	3	11.5	49.5%	2.3	9.8%	0.7	3.0%	1.0	4.3%	0.3	1.1%	15.8	67.8%	7.0	30.2%	0.0	0.0%	0.5	2.0%	7.5	32.2%	23	R 43.32
2	A010	BRACKENHURST	4	1	15.8	68.0%	3.8	16.5%	0.9	4.0%	0.7	2.9%	0.1	0.3%	21.3	91.7%	0.6	2.5%	0.1	0.6%	1.2	5.1%	1.9	8.3%	23	R 43.32
3	A011	BRACKENHURST	6	3	20.7	70.9%	4.5	15.4%	0.8	2.7%	1.1	3.9%	0.3	1.1%	27.5	94.0%	0.5	1.6%	0.0	0.0%	1.3	4.4%	1.8	6.0%	29	R 54.62
4	A013	BRACKENDOWNS	5	2	18.2	65.0%	5.5	19.6%	1.1	3.8%	0.9	3.1%	0.0	0.1%	25.6	91.6%	0.8	2.8%	0.0	0.0%	1.6	5.6%	2.3	8.4%	28	R 52.74
5	A014	BRACKENDOWNS	4	2	26.6	71.6%	5.6	15.0%	0.4	1.0%	2.0	5.3%	0.1	0.2%	34.6	93.0%	0.6	1.6%	0.2	0.5%	1.8	4.9%	2.6	7.0%	37	R 76.84
6	A015	BRACKENDOWNS	4	1	12.8	59.2%	4.1	19.0%	0.8	3.7%	1.1	5.1%	1.2	5.6%	20.0	92.7%	0.0	0.0%	0.2	0.9%	1.4	6.3%	1.6	7.3%	22	R 41.43
7	A016	BRACKENDOWNS	4	2	11.7	74.0%	2.5	15.8%	0.4	2.4%	1.0	6.5%	0.1	0.8%	15.8	99.4%	0.0	0.0%	0.0	0.3%	0.1	0.3%	0.1	0.6%	16	R 30.13
8	A017	BRACKENDOWNS	4	0	29.4	79.2%	4.5	12.1%	0.3	0.7%	1.1	3.0%	0.1	0.2%	35.3	95.2%	0.5	1.3%	0.0	0.0%	1.3	3.5%	1.8	4.8%	37	R 76.84
9	A018	BRACKENHURST	4	2	16.4	55.3%	4.0	13.4%	0.7	2.2%	1.7	5.8%	0.0	0.2%	22.9	76.9%	4.6	15.5%	0.3	1.0%	2.0	6.7%	6.9	23.1%	30	R 56.50
10	A019	BRACKENDOWNS	5	2	29.3	76.6%	5.8	15.2%	1.4	3.5%	0.6	1.6%	0.1	0.4%	37.2	97.3%	0.0	0.0%	1.0	2.5%	0.1	0.2%	1.0	2.7%	38	R 79.74
11	A020	RANDHART	6	3	30.1	51.2%	7.4	12.6%	1.6	2.7%	1.5	2.5%	1.0	1.7%	41.6	70.7%	12.3	20.9%	1.9	3.3%	3.0	5.1%	17.2	29.3%	59	R 140.76
12	A021	BRACKENHURST	4	1	10.7	46.8%	5.5	24.0%	0.9	4.1%	1.1	5.0%	0.0	0.2%	18.3	80.1%	0.8	3.4%	0.0	0.0%	3.8	16.5%	4.6	19.9%	23	R 43.32
13	A022	BRACKENDOWNS	6	0	22.8	76.1%	3.3	11.0%	0.7	2.5%	2.0	6.7%	0.9	3.1%	29.8	99.3%	0.0	0.0%	0.2	0.6%	0.0	0.1%	0.2	0.7%	30	R 56.50
14	A023	BRACKENDOWNS	6	0	15.1	62.4%	3.3	13.6%	1.1	4.7%	1.2	4.9%	0.7	2.7%	21.3	88.2%	1.2	4.9%	0.3	1.1%	1.4	5.8%	2.8	11.8%	24	R 45.20
15	A024	BRACKENDOWNS	4	2	14.6	71.7%	3.9	19.0%	0.1	0.7%	1.1	5.3%	0.3	1.3%	20.0	98.0%	0.3	1.4%	0.0	0.2%	0.1	0.3%	0.4	2.0%	20	R 37.67
16	A025	BRACKENHURST	5	3	12.4	60.3%	6.3	30.3%	0.6	2.7%	1.0	4.9%	0.1	0.5%	20.4	98.7%	0.0	0.0%	0.2	1.2%	0.0	0.1%	0.3	1.3%	21	R 39.55
17	A026	BRACKENHURST	4	0	14.6	58.3%	3.3	13.1%	0.6	2.3%	1.4	5.5%	0.4	1.5%	20.2	80.6%	2.3	9.3%	0.0	0.0%	2.5	10.0%	4.9	19.4%	25	R 47.09
18	A027	BRACKENHURST	4	1	16.6	49.6%	5.2	15.5%	1.0	3.0%	1.0	3.0%	0.3	0.8%	24.1	72.0%	7.0	21.0%	0.0	0.0%	2.4	7.1%	9.4	28.0%	34	R 68.12
19	A028	BRACKENHURST	2	0	11.1	51.7%	2.6	12.2%	0.3	1.3%	1.6	7.7%	0.0	0.2%	15.7	73.1%	1.8	8.2%	0.2	1.2%	3.8	17.6%	5.8	26.9%	22	R 41.43
20	A029	BRACKENHURST	6	1	15.5	60.8%	3.1	12.3%	0.7	2.6%	1.0	3.9%	0.4	1.6%	20.7	81.2%	1.8	6.9%	0.6	2.4%	2.4	9.5%	4.8	18.8%	26	R 48.97
21	A030	BRACKENHURST	2	0	10.0	73.7%	2.2	16.1%	0.2	1.8%	0.7	4.9%	0.1	0.5%	13.2	97.0%	0.1	0.5%	0.3	2.2%	0.0	0.4%	0.4	3.0%	14	R 26.37
22	A031	BRACKENHURST	5	2	12.9	49.9%	5.5	21.2%	0.6	2.3%	1.5	5.6%	0.4	1.4%	20.8	80.4%	4.7	18.2%	0.2	0.6%	0.2	0.8%	5.1	19.6%	26	R 48.97
23	A032	BRACKENHURST	5	3	25.1	71.2%	2.7	7.8%	0.4	1.1%	1.2	3.5%	0.3	1.0%	29.8	84.5%	4.7	13.3%	0.1	0.4%	0.6	1.8%	5.5	15.5%	35	R 71.03
24	A033	BRACKENHURST	3	0	11.8	20.9%	5.5	9.7%	0.2	0.4%	0.8	1.5%	0.3	0.5%	18.7	33.0%	32.9	58.1%	0.0	0.1%	4.9	8.8%	37.8	67.0%	57	R 134.95
25	A034	BRACKENHURST	4	0	20.8	65.4%	6.3	19.7%	0.5	1.6%	1.4	4.4%	0.0	0.1%	29.0	91.0%	2.3	7.4%	0.2	0.5%	0.3	1.1%	2.9	9.0%	32	R 62.31
26	A035	BRACKENHURST	4	0	11.4	49.1%	5.0	21.7%	1.0	0.0%	0.4	1.8%	0.0	0.2%	17.9	72.8%	1.6	6.7%	0.1	0.4%	3.7	15.9%	5.3	23.0%	23	R 43.32
27	A036	BRACKENHURST	4	2	25.6	79.2%	3.5	10.9%	0.6	1.9%	1.1	3.4%	0.0	0.1%	30.8	95.4%	0.0	0.0%	0.2	0.8%	1.2	3.8%	1.5	4.6%	32	R 62.31
28	A037	BRACKENHURST	4	0	22.8	41.3%	5.9	10.7%	0.1	0.3%	2.3	4.2%	0.4	0.8%	31.6	57.2%	18.8	34.0%	0.2	0.3%	4.7	8.5%	23.7	42.8%	55	R 129.13
29	A038	BRACKENHURST	5	0	17.8	48.8%	5.5	15.0%	0.5	1.5%	0.6	1.7%	0.3	0.9%	24.8	67.9%	9.4	25.7%	0.0	0.0%	2.3	6.4%	11.7	32.1%	37	R 76.84
30	A053	RANDHART	3	1	6.6	38.7%	2.7	15.6%	0.7	4.3%	0.3	1.9%	0.1	0.4%	10.4	61.0%	6.5	38.0%	0.1	0.5%	0.1	0.5%	6.6	39.0%	17	R 32.02
31	A054	RANDHART	3	0	10.6	55.9%	2.1	11.1%	0.5	2.5%	0.2	1.2%	0.4	1.9%	13.8	72.8%	4.7	24.7%	0.3	1.4%	0.2	1.1%	5.2	27.2%	19	R 35.78
32	A055	RANDHART	5	2	21.4	66.8%	4.1	12.8%	0.2	0.6%	0.9	2.7%	0.7	2.0%	27.3	84.9%	4.7	14.6%	0.2	0.5%	0.0	0.0%	4.9	15.1%	32	R 62.31
33	A056	RANDHART	5	3	14.2	56.5%	1.6	6.5%	0.3	1.0%	0.6	2.2%	0.1	0.4%	16.8	66.6%	3.5	14.0%	0.2	0.7%	4.7	18.7%	8.4	33.4%	25	R 47.09
34	A057	RANDHART	7	3	19.8	70.2%	4.8	17.2%	0.6	2.1%	1.6	5.8%	0.1	0.4%	26.9	95.5%	0.0	0.0%	0.1	0.3%	1.2	4.2%	1.3	4.5%	28	R 52.74
35	A058	RANDHART	6	1	26.5	77.8%	4.4	12.9%	0.5	1.4%	0.7	2.2%	0.5	1.4%	32.5	95.6%	1.4	4.0%	0.0	0.0%	0.1	0.4%	1.5	4.4%	34	R 68.12
36	A059	RANDHART	3	0	17.4	67.2%	1.3	4.8%	0.3	1.2%	1.1	4.3%	0.3	1.3%	20.4	78.8%	3.5	13.6%	0.9	3.4%	1.1	4.2%	5.5	21.2%	26	R 48.97
37	A060	RANDHART	6	1	16.2	53.5%	5.5	18.0%	0.8	2.5%	1.7	5.6%	0.2	0.8%	24.4	80.5%	4.7	15.5%	0.1	0.4%	1.1	3.7%	5.9	19.5%	30	R 56.50
38	A061	RANDHART	4	1	23.7	86.3%	1.7	6.3%	0.5	1.9%	1.2	4.3%	0.3	1.2%	27.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	27	R 50.85
39	A062	RANDHART	5	2	21.4	68.0%	4.5	14.3%	0.5	1.6%	1.1	3.6%	0.4	1.1%	27.9	88.6%	1.8	5.6%	0.0	0.1%	1.8	5.7%	3.6	11.4%	32	R 62.31
40	A063	RANDHART	4	0	17.5	58.6%	3.8	12.6%	0.2	0.7%	0.3	1.2%	0.1	0.3%	21.9	73.3%	4.7	15.7%	0.3	1.0%	3.0	9.9%	8.0	26.7%	30	R 56.50
41	A064	RANDHART	7	2	29.7	57.7%	4.1	8.0%	0.6	1.3%	1.1	2.1%	0.9	1.8%	36.4	70.8%	13.7	26.6%	0.1	0.2%	1.2	2.4%	15.0	29.2%	51	R 117.51
42	A083	MEYERSDAL	5	2	10.5	41.6%	3.0	11.9%	0.4	1.6%	1.1	4.2%	0.3	1.1%	15.3	60.4%	0.0	0.0%	0.0	0.0%	10.0	39.6%	10.0	39.6%	25	R 47.09
43	A090	MEYERSDAL EXT 21	2	0	11.0	72.7%	1.6	10.9%	0.1	0.7%	1.0	6.4%	0.1	0.7%	13.8	91.4%	1.0	6.5%	0.3	2.1%	0.0	0.0%	1.3	8.6%	15	R 28.25
44	A091	BRACKENDOWNS	3	1	10.4	66.0%	4.1	26.1%	0.4	2.6%	0.8	4.8%	0.1	0.5%	15.7	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	16	R 30.13
45	A092	BRACKENHURST	2	0	8.9	51.8%	3.6	20.8%	0.4	2.4%	0.5	3.0%	0.1	0.4%	13.5	78.4%	3.5	20.4%	0.2	1.3%	0.0	0.0%	3.7	21.6%	17	R 32.02
46	A093	ALBERANTE	3	0	8.6	59.6%	4.5	31.0%	0.3	2.4%	0.9	6.2%	0.1	0.7%	14.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	14	R 26.37
47	A097	BRACKENHURST	7	2	13.2	40.0%	5.2	15.7%	0.5	1.5%	1.2	3.5%	0.1	0.3%	20.2	61.0%	10.6	31.9%	0.0	0.0%	2.3	7.1%	12.9	39.0%	33	R 65.22
48	A098	BRACKENHURST	3	0	8.3	55.9%	3.1	21.1%	0.4	2.8%	0.3	2.2%	0.1	0.6%	12.2	83%	1.2	7.9%	0.2	1.1%	1.2	8.3%	2.6	17.4%	15	R 28.25
49	A099	BRACKENHURST	2	0	7.3	42.5%	2.2	12.8%	0.4	2.1%	0.6	3.8%	0.2	1.1%	10.6	62.3%	4.7	27.5%	0.0	0.0%	1.7	10.2%	6.4	37.7%	17	R 32.02
50	A107	RANDHART	6	1	24.9	60.6%	7.8	18.9%	1.5	3.6%	1.5	3.6%	0.6	1.5%	36.2	88.2%	4.5	11.0%	0.3	0.7%	0.0	0.1%	4.8	11.8%	41	R 88.46
51	A112	BRACKENDOWNS	2	0	8.8	44.4%	2.2	11.0%	0.4	1.8%	1.0	5.1%	0.1	0.3%	12.4	62.6%	7.4	37.4%	0.0	0.0%	0.0	0.0%	7.4	37.4%	20	R 37.67
52	A113	BRAKENHURST	3	0	12.3	62.6%	2.8	14.1%	0.6	2.9%	1.0	5.0%	0.2	1.0%	16.8	85.6%	1.1	5.4%	0.6	3.0%	1.2	6.0%	2.8	14.4%	20	R 37.67

Table D.3

APPENDIX E

Contingent Valuation Survey Questionnaire

WATER USAGE SURVEY No. 2

Water usage for selected households in Alberton and Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	
Township name	
Erf number	
Address	
Telephone Number	
Date of interview	
Number of adults in household (including domestic servants)	
Number of children in household (under 18)	

No.	Question	Prompt
1	Discuss and agree on the estimate of the profile of water usage of the household, including the average summer monthly consumption figure and the resulting water bill.	Show the figures obtained in the first survey. Highlight the usage of water in the various categories summarised on the attached sheet. Discuss and record any changes.
2	Would your water consumption change if the price was increased to: _____cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 3. If NO record new water bill and proceed to question 4.
3	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
4	Would your water consumption change if the price was increased to: _____cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 5. If NO record new water bill and proceed to question 6.
5	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
6	Would your water consumption change if the price was increased to: _____cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 7. If NO record new water bill.
7	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
End of Questionnaire		

RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1				
2				
3				
4				
5				
6				
7				

CV SURVEY PROMPT LIST

Methods of Saving Water

Indoors		
No	**Prompts**	**Consequences**
1	Avoid warm-up lag	9 litres/min
2	Keep a basin in the sink	15 litres per sink
3	Discourage children from turning on taps	9 litres/min
4	Save dishes for one wash	15 litres per sink
5	Do not wash hands with running water	Compare 9 litres/min with 10 litres in basin
6	Do not run tap while cleaning teeth	9 litres/min
7	Use cup while cleaning teeth	250 milli-litres per cup
8	Do not fill hand basin	Average filled basin uses 10 litres
9	Check and fix dripping taps	
10	Do not turn taps full on	½ inch taps: 9 litres/min ¾ inch taps: 15 litres/min
11	Turn taps off properly	
12	Reduce water level in washing machine	Compare with size of washing machine specified in response to *Questionnaire 1*.
13	Have more clothes per wash	Reduced use of washing machine – refer to size of washing machine used
14	Do not wash clothes every day	Reduced use of washing machine – refer to size of washing machine used
15	Turn shower off while soaping up	12 litres/min
16	Do not shave under the shower	12 litres/min
17	Do not wash hair under the shower	12 litres/min compare with number of basins of water used at 10 litres/basin
18	Have a shallow bath	Average bath ½ full = 120 litres
19	Let children share baths	Average bath ½ full = 120 litres
20	Have shorter showers	12 litres/min
21	Time showers	12 litres/min
22	Use a shower restrictor	Reduce to say to 8 litres/min
23	Use a suds saver on washing machine	
24	Buy a low water using machine	Compare with present size of machine
25	Do not use the washing machine	Refer to size of washing machine used and compare with washing in sink at 15 to 20 litres/sink
26	Do not use the dishwasher	Refer to size of washing machine used and compare with washing in sink at 15l/sink
27	Install reduced-flush cistern	9 litres compared to 11 litres
28	Bend float arm in cistern	< 9 or 11 litres/flush
29	Do not always flush the toilet	9 or 11 litres per flush

Outdoors		
No.	**Prompts**	**Consequences**
1	Install a bore hole	½ inch tap: 9 litres /min ¾ inch tap: 15 litres/min
2	Make more us of the bore hole	
3	Limit sprinkler use	
4	Time the sprinkler	
5	Stop children using sprinklers	
6	Install a trickle system	
7	Water the garden selectively	
8	Do not water lawns in the winter	
9	Put less water on the lawn	
10	Water garden on alternate days	
11	Water twice a week	
12	Hand water only	
13	Use buckets not hoses	
14	Stop watering the garden	
15	Shade outdoor area	
16	Use mulches on garden	
17	Use drought-resistant plants	
18	Pave part of outdoor area	
19	Pave half the oudoor area	
20	Pave all the outdoor area	
21	Reduce lawn by up to a half	
22	Reduce lawn by over a half	
23	Do not run hose in car washing	
24	Wash car witth a bucket	
25	Do not use hose for car	
26	Wash car on lawn	
27	Use bore hole water for car washing	
28	Use washing water in garden	
29	Use roof run-off	
30	Recycle water	
31	No jumping into swimming pool	
32	Cover swimming pool	
33	Use rain water to fill pool	
34	Remove swimming pool	
35	Install rain water tank	

Average Basic Water Usage Rates for Indoors and Outdoors

1. **Bath** — 120 litres (1/2 full)
2. **Toilet cistern** — 9 litres (popular) (11 litres previously used)
3. **Shower** — 12 litres per minute (average shower is 6 to7 minutes long, using 70 litres of water)
4. **Jacuzzi** — 200 litres
5. **Sink** — 15 litres (average filled for dishes)
6. **Basin** — 10 litres (average filled)
7. **Taps (indoors and outdoors):**

   ½ inch: 9 litres per minute
   ¼ inch: 15 litres per minute

8. **Washing machines:**

   Average for full load:
   5 kg: 16 litres (varies between 9 and 23 litres)
   6 kg: 19 litres
   8 kg: 26 litres
   8.5 kg: 27 litres

9. **Dish washing machines: average of 25 litres**
10. **When designing new water supply system, Cobra-Tech size the system based on the use of 100 litres per day per person for a household of 6 persons.**
11. **Buckets: average bucket: 10 litres**

    For Thokoza: 25 litres for washing clothes and bathing
    10 litres for cooking and washing floors

12. **Miscellanoeus:** Jug: 1 litre
    Pot: 2 litres

Note: The above figures (items 1-8) were obtained from Cobra Water Tech., (Ms Sue Botha 951-5000) and are based on common average sized items.

Alberton Municipality
Table 1
Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs + 100%		Present Water Costs + 150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
1	188.34	1.88	282.51	2.83	376.68	3.77	470.85	4.71
2	188.34	3.77	282.51	5.65	376.68	7.53	470.85	9.42
3	188.34	5.65	282.51	8.48	376.68	11.30	470.85	14.13
4	188.34	7.53	282.51	11.30	376.68	15.07	470.85	18.83
5	188.34	9.42	282.51	14.13	376.68	18.83	470.85	23.54
6	188.34	11.30	282.51	16.95	376.68	22.60	470.85	28.25
7	188.34	13.18	282.51	19.78	376.68	26.37	470.85	32.96
8	188.34	15.07	282.51	22.60	376.68	30.13	470.85	37.67
9	188.34	16.95	282.51	25.43	376.68	33.90	470.85	42.38
10	188.34	18.83	282.51	28.25	376.68	37.67	470.85	47.09
11	188.34	20.72	282.51	31.08	376.68	41.43	470.85	51.79
12	188.34	22.60	282.51	33.90	376.68	45.20	470.85	56.50
13	188.34	24.48	282.51	36.73	376.68	48.97	470.85	61.21
14	188.34	26.37	282.51	39.55	376.68	52.74	470.85	65.92
15	188.34	28.25	282.51	42.38	376.68	56.50	470.85	70.63
16	188.34	30.13	282.51	45.20	376.68	60.27	470.85	75.34
17	188.34	32.02	282.51	48.03	376.68	64.04	470.85	80.04
18	188.34	33.90	282.51	50.85	376.68	67.80	470.85	84.75
19	188.34	35.78	282.51	53.68	376.68	71.57	470.85	89.46
20	188.34	37.67	282.51	56.50	376.68	75.34	470.85	94.17

Alberton Municipality
Table 1
Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs + 100%		Present Water Costs + 150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
21	188.34	39.55	282.51	59.33	376.68	79.10	470.85	98.88
22	188.34	41.43	282.51	62.15	376.68	82.87	470.85	103.59
23	188.34	43.32	282.51	64.98	376.68	86.64	470.85	108.30
24	188.34	45.20	282.51	67.80	376.68	90.40	470.85	113.00
25	188.34	47.09	282.51	70.63	376.68	94.17	470.85	117.71
26	188.34	48.97	282.51	73.45	376.68	97.94	470.85	122.42
27	188.34	50.85	282.51	76.28	376.68	101.70	470.85	127.13
28	188.34	52.74	282.51	79.10	376.68	105.47	470.85	131.84
29	188.34	54.62	282.51	81.93	376.68	109.24	470.85	136.55
30	188.34	56.50	282.51	84.75	376.68	113.00	470.85	141.26
31	191.64	59.41	287.45	89.11	383.27	118.81	479.09	148.52
32	194.73	62.31	292.09	93.47	389.45	124.63	486.82	155.78
33	197.63	65.22	296.45	97.83	395.26	130.44	494.08	163.04
34	200.36	68.12	300.54	102.18	400.72	136.25	500.91	170.31
35	202.94	71.03	304.41	106.54	405.88	142.06	507.35	177.57
36	205.37	73.93	308.06	110.90	410.74	147.87	513.43	184.83
37	207.67	76.84	311.51	115.26	415.35	153.68	519.18	192.10
38	209.85	79.74	314.78	119.62	419.71	159.49	524.63	199.36
39	211.92	82.65	317.88	123.97	423.84	165.30	529.81	206.62
40	213.89	85.56	320.83	128.33	427.78	171.11	534.72	213.89

Alberton Municipality
Table 1
Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs +100%		Present Water Costs +150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
41	215.76	88.46	323.64	132.69	431.51	176.92	539.39	221.15
42	217.54	91.37	326.31	137.05	435.07	182.73	543.84	228.41
43	219.23	94.27	328.85	141.41	438.47	188.54	548.09	235.68
44	220.86	97.18	331.28	145.76	441.71	194.35	552.14	242.94
45	222.40	100.08	333.61	150.12	444.81	200.16	556.01	250.20
46	223.88	102.99	335.83	154.48	447.77	205.97	559.71	257.47
47	225.30	105.89	337.95	158.84	450.60	211.78	563.26	264.73
48	226.66	108.80	339.99	163.20	453.32	217.59	566.65	271.99
49	227.96	111.70	341.95	167.55	455.93	223.41	569.91	279.26
50	229.22	114.61	343.82	171.91	458.43	229.22	573.04	286.52
51	230.42	117.51	345.63	176.27	460.84	235.03	576.05	293.78
52	231.57	120.42	347.36	180.63	463.15	240.84	578.94	301.05
53	232.69	123.32	349.03	184.99	465.37	246.65	581.72	308.31
54	233.76	126.23	350.64	189.34	467.52	252.46	584.39	315.57
55	234.79	129.13	352.19	193.70	469.58	258.27	586.98	322.84
56	235.79	132.04	353.68	198.06	471.57	264.08	589.46	330.10
57	236.75	134.95	355.12	202.42	473.49	269.89	591.86	337.36
58	237.67	137.85	356.51	206.78	475.35	275.70	594.18	344.63
59	238.57	140.76	357.85	211.13	477.14	281.51	596.42	351.89
60	239.44	143.66	359.15	215.49	478.87	287.32	598.59	359.15

Alberton Municipality
Table 1
Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs + 100%		Present Water Costs + 150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
61	240.27	146.57	360.41	219.85	480.55	293.13	600.68	366.42
62	241.08	149.47	361.62	224.21	482.17	298.94	602.71	373.68
63	241.87	152.38	362.80	228.57	483.74	304.75	604.67	380.94
64	242.63	155.28	363.94	232.92	485.26	310.56	606.57	388.21
65	243.37	158.19	365.05	237.28	486.73	316.38	608.41	395.47
66	244.08	161.09	366.12	241.64	488.16	322.19	610.20	402.73
67	244.77	164.00	367.16	246.00	489.55	328.00	611.93	410.00
68	245.45	166.90	368.17	250.36	490.89	333.81	613.62	417.26
69	246.10	169.81	369.15	254.71	492.20	339.62	615.25	424.52
70	246.73	172.71	370.10	259.07	493.47	345.43	616.84	431.79
71	247.35	175.62	371.03	263.43	494.70	351.24	618.38	439.05
72	247.95	178.52	371.93	267.79	495.90	357.05	619.88	446.31
73	248.53	181.43	372.80	272.14	497.07	362.86	621.34	453.57
74	249.10	184.34	373.65	276.50	498.20	368.67	622.75	460.84
75	249.65	187.24	374.48	280.86	499.31	374.48	624.14	468.10
76	250.19	190.15	375.29	285.22	500.38	380.29	625.48	475.36
77	250.72	193.05	376.07	289.58	501.43	386.10	626.79	482.63
78	251.23	195.96	376.84	293.93	502.45	391.91	628.07	489.89
79	251.72	198.86	377.59	298.29	503.45	397.72	629.31	497.15
80	252.21	201.77	378.31	302.65	504.42	403.53	630.52	504.42

APPENDIX F

Comments by Thokoza Respondents on
the Water Usage Profile Survey

APPENDIX F

Comments Made by Respondents from Thokoza during the Water Usage Profile Survey

1. Introduction

In Thokoza there was universal enthusiasm for the Water Usage Profile Survey and comments on its usefulness as an educational tool were received from many of the participants. Comments from nearly 30% of the respondents were received; a summary of the essential points arising from these comments is given below.

2. Summary of the Comments

The essential points arising from the comments from the Thokoza respondents were:

- The South African community as a whole, and the black townships in particular, should be taught how to save water by means of the radio, TV, newspapers, magazines and workshops. Local governments and local councils should be actively involved in educating people on how to save water and how to use water more sparingly. It was advocated that the Water usage Profile Survey should be an ongoing process in order to keep reminding South Africans how to save water and of the impending water shortage crisis.
- Local governments should be active in preventing theft of water by illegal means i.e. illegal connections, as well as looking at ways to stop water loss through leakage. It was mentioned that at least 38% of the houses in Thokoza had outside taps, which were leaking and irreparable, and that most water meters are leaking, resulting in water wastage and high bills.
- It was recommended that the unit price of water should be high, as this would make people use water more wisely and more sparingly.

- There was generally a very good awareness of the scarcity of water and the possible future water shortage crisis. It was mentioned however that people at grass root level need to be made more aware of the shortage of water as well as clarification on how to use water wisely .
- The Water Research Commission was thanked for having initiated the project on how to conserve water, and it was suggested that the WRC should continue to spread to all citizens of South Africa.

3. Conclusions

In conclusion, the Thokoza residents involved in the study saw the Water Usage Profile Survey as a good educational tool; they believed that confronted with their actual water usage patterns aided them in learning how to manage water in a more efficient manner. They were unanimous that this survey should be ongoing in order to educate people how to conserve water and thereby ensure that South African citizens use water more wisely.

APPENDIX G

Examples of the Results of the CV Survey
in Alberton and Thokoza

Example of Results of CV Survey in Alberton

WATER USAGE SURVEY No. 2

Water usage for selected households in Alberton and Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	Respondent No. A3
Township name	Alberton North
Erf number	639
Address	43 7th Laan Alberton North
Telephone Number	C/o Municipality
Date of interview	3rd June 1998
Number of adults in household (including domestic servants)	5
Number of children in household (under 18)	

No.	Question	Prompt
1	Discuss and agree on the estimate of the profile of water usage of the household, including the average summer monthly consumption figure and the resulting water bill.	Show the figures obtained in the first survey. Highlight the usage of water in the various categories summarised on the attached sheet. Discuss and record any changes.
2	Would your water consumption change if the price was increased to: __303.06__ cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 3. If NO record new water bill and proceed to question 4.
3	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
4	Would your water consumption change if the price was increased to: __410.74__ cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 5. If NO record new water bill and proceed to question 6.
5	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
6	Would your water consumption change if the price was increased to: __513.43__ cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 7. If NO record new water bill.
7	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
End of Questionnaire		

RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	205.37	36	73.93	Agrees with Survey No. 1 results
2	303.06	36	110.90	
3	300.54	34	102.18	Save 1 kilo litre in garden Save 1 kilo litre in bathroom
4	410.74	36	147.37	
5	389.45	32	124.63	Save 2 kilo litres in garden Save 2 kilo litres in bathroom
6	513.43	36	184.83	
7	479.09	31	148.52	Save 2 kilo litres in garden Save 3 kilo litres in bathroom

Example of Results of Survey No.1

General Information:

Name of Respondent:	No. A3
Township:	Alberton North
Erf number:	639
Account number:	36625
Number of persons:	5

Household Profile:

Water usage over 2 weeks		
Indoor usage:	**Litres**	**%**
Bathroom	11 952	71.4%
Toilet	1 260	7.5%
Laundry	433	2.6%
Kitchen	1 063	6.4%
Other	40	0.2%
Sub-Total	14 748	88.1%
Outdoor usage:		
Garden	1 710	10.2%
Car	275	1.6%
Other	0	0.0%
Sub-Total	1 985	11.9%
Total	16 733	100%

Summary of Results:

Average water usage per day	1 195	litres/day
Average water usage per month	36	klitres/month
Equivalent monthly bill	R 73.93	

Example of Results of CV Survey in Thokoza

WATER USAGE SURVEY No. 2

Water usage for selected households in Alberton and Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	Respondent No. T33
Township name	Thokoza
Erf number	95
Address	
Telephone Number	
Date of interview	2nd April 1998
Number of adults in household (including domestic servants)	2
Number of children in household (under 18)	4

No.	Question	Prompt
1	Discuss and agree on the estimate of the profile of water usage of the household, including the average summer monthly consumption figure and the resulting water bill.	Show the figures obtained in the first survey. Highlight the usage of water in the various categories summarised on the attached sheet. Discuss and record any changes.
2	Would your water consumption change if the price was increased to: __282.51__cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 3. If NO record new water bill and proceed to question 4.
3	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
4	Would your water consumption change if the price was increased to: __376.68__ cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 5. If NO record new water bill and proceed to question 6.
5	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
6	Would your water consumption change if the price was increased to: __470.85__ cents per kilo-litre?	Show the resulting new monthly water bill using Table 1.
Answer	**YES / NO**	If YES proceed to question 7. If NO record new water bill.
7	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
End of Questionnaire		

RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	188.34	12	22.60	Agrees with Survey No. 1 results
2	282.51	12	33.90	
3	282.51	12	33.90	Accepts new bill
4	376.68	12	45.20	
5	376.68	11	41.43	Decides to save 1 kilo litre in bathroom
6	470.85	12	56.50	
7	470.85	10	47.09	Decides to save 2 kilo litre in bathroom

Example of Results of Survey No.1

General Information:

Name of Respondent:	No. T33
Township:	Thokoza
Erf number:	95
Account number:	
Number of persons:	6

Household Profile:

Water usage over 1 week		
Indoor usage:	**Litres**	**%**
Bathroom	1 374	51.0%
Toilet	90	3.3%
Laundry	360	13.4%
Kitchen	51	1.9%
Other	120	4.5%
Sub-Total	1 995	74.0%
Outdoor usage:		
Garden	495	18.4%
Car	188	7.0%
Other	18	0.7%
Sub-Total	701	26.0%
Total	2 696	100%

Summary of Results:

Average water usage per day	385	litres/day
Average water usage per month	12	klitres/month
Equivalent monthly bill	R 22.60	

APPENDIX H

CV Survey Database

CV Survey Database for Lower Income Group (L)

No.	Respond No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP + 50%)					Water Usage (PP + 100%)					Water Usage (PP + 150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A100	EDEN PARK	6	2	29.7	0.3	30.0	188.3	56.50	29.7	0.3	29.0	282.5	81.93	28.7	0.2	29.0	376.7	109.24	29.7	0.3	29.0	470.9	136.50
2	A110	EDEN PARK	7	2	37.9	0.1	38.0	299.9	79.74	36.9	0.1	37.0	311.5	115.26	34.9	0.1	35.0	405.9	142.06	34.9	0.1	35.0	507.4	177.57
3	T01	Thokoza	2	0	7.6	1.4	9.0	188.3	16.96	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	4.6	1.4	6.0	470.9	28.25
4	T02	Thokoza	3	1	13.3	0.7	14.0	188.3	26.37	13.3	0.7	14.0	282.5	39.55	12.3	0.7	13.0	376.7	48.97	11.3	0.7	12.0	470.9	56.50
5	T03	Thokoza	8	3	31.8	4.2	36.0	205.4	73.93	31.8	4.2	36.0	308.9	111.19	29.8	4.2	34.0	400.7	136.24	28.8	4.2	33.0	494.1	163.05
6	T04	Thokoza	14	6	26.1	0.9	27.0	188.3	50.85	25.1	0.9	27.0	282.5	76.28	25.1	0.9	26.0	376.7	97.94	24.1	0.9	25.0	470.9	117.75
7	T05	Thokoza	9	4	26.9	3.1	30.0	188.3	56.50	23.9	3.1	27.0	282.5	76.28	23.9	3.1	25.0	376.7	94.17	20.9	3.1	24.0	470.9	113.00
8	T06	Thokoza	7	3	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
9	T07	Thokoza	5	3	14.0	2.0	16.0	188.3	30.13	14.0	2.0	16.0	282.5	45.20	13.0	2.0	15.0	376.7	56.50	12.0	2.0	14.0	470.9	65.92
10	T08	Thokoza	7	4	21.6	1.4	23.0	188.3	43.32	21.6	1.4	23.0	282.5	64.98	21.6	1.4	23.0	376.7	86.64	19.6	1.4	21.0	470.9	98.85
11	T09	Thokoza	8	2	34.5	2.5	37.0	188.3	76.84	34.5	2.5	37.0	311.5	115.26	32.5	2.5	35.0	405.9	142.06	31.5	2.5	34.0	500.9	170.31
12	T10	Thokoza	8	3	35.9	3.1	39.0	188.3	82.65	35.9	3.1	39.0	317.9	123.97	34.9	3.1	38.0	411.7	156.43	33.9	3.1	37.0	519.2	192.13
13	T11	Thokoza	11	1	9.2	4.8	14.0	188.3	26.37	9.2	4.8	14.0	282.5	39.55	8.2	4.8	13.0	376.7	48.97	8.2	3.8	12.0	470.9	56.50
14	T12	Thokoza	6	2	28.0	0.0	28.0	188.3	52.74	28.0	0.0	28.0	282.5	79.10	28.0	0.0	28.0	376.7	105.47	25.0	0.0	25.0	470.9	117.73
15	T13	Thokoza	4	2	7.6	1.4	9.0	188.3	16.96	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	5.6	1.4	7.0	470.9	32.96
16	T14	Thokoza	6	2	18.6	0.4	19.0	188.3	35.78	16.6	0.4	17.0	282.5	48.03	16.6	0.4	17.0	376.7	64.04	14.6	0.4	15.0	470.9	70.63
17	T15	Thokoza	7	3	8.4	1.6	10.0	188.3	18.83	8.4	1.6	10.0	282.5	28.25	7.4	1.6	9.0	376.7	33.90	7.4	0.6	8.0	470.9	37.67
18	T16	Thokoza	6	4	15.3	3.7	19.0	188.3	35.78	15.3	3.7	19.0	282.5	53.68	14.3	3.7	18.0	376.7	67.80	13.3	2.7	16.0	470.9	75.34
19	T17	Thokoza	6	1	9.6	7.4	17.0	188.3	32.02	9.6	7.4	17.0	282.5	48.03	5.6	6.4	16.0	376.7	60.27	8.6	6.4	15.0	470.9	70.63
20	T18	Thokoza	4	2	14.7	7.3	22.0	188.3	41.43	14.7	7.3	22.0	282.5	62.15	12.7	7.3	20.0	376.7	75.34	12.7	5.3	18.0	470.9	84.75
21	T19	Thokoza	10	4	14.8	0.2	15.0	188.3	28.25	14.8	0.2	15.0	282.5	42.38	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.27
22	T20	Thokoza	3	0	32.5	16.5	49.0	229.9	111.70	27.5	16.5	44.0	331.3	145.76	27.5	13.5	41.0	431.5	176.92	27.5	13.5	41.0	539.4	221.15
23	T21	Thokoza	11	5	26.1	18.9	45.0	222.4	100.08	24.1	18.9	43.0	328.9	141.41	24.1	16.9	41.0	431.5	176.92	23.1	16.9	40.0	534.7	213.88
24	T22	Thokoza	9	5	21.0	2.0	23.0	188.3	43.32	20.0	2.0	22.0	282.5	62.15	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
25	T23	Thokoza	5	2	23.8	2.2	26.0	188.3	48.97	21.8	2.2	24.0	282.5	67.80	20.8	2.2	23.0	376.7	86.64	20.8	2.2	23.0	470.9	108.30
26	T24	Thokoza	5	3	21.2	3.8	25.0	188.3	47.09	20.2	3.8	24.0	282.5	67.80	20.2	3.8	24.0	376.7	90.40	20.2	3.8	24.0	470.9	113.00
27	T25	Thokoza	2	1	6.6	6.4	13.0	188.3	24.48	5.6	5.4	11.0	282.5	31.08	5.6	5.4	11.0	376.7	41.43	5.6	5.4	11.0	470.9	51.76
28	T26	Thokoza	7	4	20.8	1.2	22.0	188.3	41.43	20.8	1.2	22.0	282.5	62.15	19.8	1.2	21.0	376.7	79.10	18.8	1.2	20.0	470.9	94.17
29	T27	Thokoza	4	2	11.8	6.2	18.0	188.3	33.90	11.8	6.2	18.0	282.5	50.85	11.8	6.2	18.0	376.7	67.80	10.8	4.2	15.0	470.9	70.63
30	T28	Thokoza	6	3	19.7	0.3	20.0	188.3	37.67	19.7	0.3	20.0	282.5	56.50	17.7	0.3	18.0	376.7	67.80	17.7	0.3	18.0	470.9	84.75
31	T29	Thokoza	9	2	22.2	2.8	25.0	188.3	47.09	22.2	2.8	25.0	282.5	70.63	22.2	2.8	25.0	376.7	94.17	22.2	2.8	25.0	470.9	117.71
32	T30	Thokoza	7	4	25.5	1.5	27.0	188.3	50.85	23.5	1.5	25.0	282.5	70.63	22.5	1.5	24.0	376.7	90.40	22.5	1.5	24.0	470.9	113.00
33	T31	Thokoza	4	3	19.1	6.0	25.0	188.3	47.09	19.1	6.0	25.0	282.5	70.63	19.1	6.0	25.0	376.7	94.17	17.1	6.0	23.0	470.9	108.30
34	T32	Thokoza	5	2	21.2	0.8	22.0	188.3	41.43	21.2	0.8	22.0	282.5	62.15	20.2	0.8	21.0	376.7	79.10	20.2	0.8	21.0	470.9	98.89
35	T33	Thokoza	6	4	8.9	3.1	12.0	188.3	22.60	8.9	3.1	12.0	282.5	33.90	7.9	3.1	11.0	376.7	41.43	6.9	3.1	10.0	470.9	47.09
36	T34	Thokoza	14	0	19.0	13.0	32.0	194.7	62.31	18.0	13.0	31.0	287.6	89.11	18.0	12.0	30.0	376.7	113.00	18.0	11.0	29.0	470.9	136.55
37	T35	Thokoza	4	2	6.3	1.7	8.0	188.3	15.07	6.3	1.7	8.0	282.5	22.60	6.3	1.7	8.0	376.7	30.13	6.3	0.7	7.0	470.9	32.96
38	T36	Thokoza	9	3	13.7	0.3	14.0	188.3	26.37	12.7	0.3	13.0	282.5	36.73	12.7	0.3	13.0	376.7	48.97	11.7	0.3	12.0	470.9	56.50
39	T37	Thokoza	10	6	10.7	7.3	18.0	188.3	33.90	8.7	7.3	16.0	282.5	45.20	8.7	6.3	15.0	376.7	56.50	8.7	5.3	14.0	470.9	65.92
40	T38	Thokoza	8	5	29.6	10.5	39.0	211.9	82.65	26.5	10.5	37.0	311.5	115.26	26.5	9.5	36.0	411.7	147.87	25.5	8.5	34.0	560.9	170.31
41	T40	Thokoza	12	7	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
42	T41	Thokoza	5	3	21.9	0.1	22.0	188.3	41.43	21.9	0.1	22.0	282.5	62.15	20.9	0.1	21.0	376.7	79.10	19.9	0.1	20.0	470.9	94.17
43	T42	Thokoza	3	0	2.9	0.1	3.0	188.3	5.65	2.9	0.1	3.0	282.5	8.48	2.9	0.1	3.0	376.7	11.30	2.9	0.1	3.0	470.9	14.13
44	T43	Thokoza	4	2	3.0	0.0	3.0	188.3	5.65	3.0	0.0	3.0	282.5	8.48	3.0	0.0	3.0	376.7	11.30	3.0	0.0	3.0	470.9	14.13
45	T44	Thokoza	8	4	14.1	3.9	18.0	188.3	33.90	13.1	3.9	17.0	282.5	48.03	12.1	3.9	16.0	376.7	60.27	12.1	2.9	15.0	470.9	70.63
46	T45	Thokoza	7	3	4.0	0.0	4.0	188.3	7.53	4.0	0.0	4.0	282.5	11.30	4.0	0.0	4.0	376.7	15.07	4.0	0.0	4.0	470.9	18.83
47	T46	Thokoza	6	2	7.3	3.7	11.0	188.3	20.72	6.3	3.7	10.0	282.5	28.25	5.3	3.7	9.0	376.7	33.90	4.3	3.7	8.0	470.9	37.67
48	T47	Thokoza	7	3	6.2	1.8	8.0	188.3	15.07	6.2	1.8	8.0	282.5	22.60	4.2	1.8	6.0	376.7	22.60	4.2	0.8	5.0	470.9	23.54
49	T48	Thokoza	8	3	6.6	1.4	8.0	188.3	15.07	6.6	1.4	8.0	282.5	22.60	5.6	1.4	7.0	376.7	26.37	4.6	1.4	6.0	470.9	28.25
50	T49	Thokoza	2	0	27.3	8.7	36.0	205.4	73.93	26.3	8.7	35.0	304.4	106.54	26.3	8.7	35.0	401.9	142.06	25.3	8.7	34.0	500.9	170.31

Note: PP = Present price
I = Indoors
O = Outdoors
T = Total
C = Cents
R = Rand

Table H.1

CV Survey Database for Middle Income Group (M)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP+50%)					Water Usage (PP+100%)					Water Usage (PP+150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A002	MAYBERRY PARK	5	3	40.3	0.7	41.0	215.8	86.46	38.3	0.7	39.0	317.9	123.97	37.3	0.7	38.0	419.7	159.49	37.3	0.7	38.0	524.8	199.36
2	A003	ALBERTON NORTH	5	0	31.7	4.3	36.0	205.4	73.93	30.7	3.3	34.0	300.5	102.18	29.7	2.3	32.0	389.5	124.62	28.7	2.3	31.0	479.1	148.52
3	A004	FLORENTIA	3	0	13.9	1.1	15.0	188.3	28.25	13.9	1.1	15.0	282.5	42.38	11.9	1.1	13.0	376.7	48.97	9.9	1.1	11.0	470.9	51.79
4	A005	ALBERTON NOORD	5	1	21.7	0.3	22.0	188.3	41.43	21.7	0.3	22.0	282.5	62.15	19.7	0.3	20.0	376.7	75.34	17.7	0.3	18.0	470.9	84.75
5	A006	ALBERTON NORTH	6	2	31.6	3.4	35.0	202.9	71.03	31.6	3.4	35.0	304.4	106.54	30.6	1.4	32.0	389.5	124.62	28.6	1.4	30.0	470.9	141.28
6	A007	ALBERTON NORTH	3	1	16.5	6.5	23.0	188.3	43.32	16.5	4.5	21.0	282.5	59.33	15.5	4.5	20.0	376.7	75.34	15.5	4.5	20.0	470.9	94.17
7	A008	ALBERTSDAL	1	0	7.2	0.8	8.0	188.3	15.07	7.2	0.8	8.0	282.5	22.60	6.2	0.8	7.0	376.7	26.37	6.2	0.8	7.0	470.9	32.95
8	A009	ALBERTSDAL	2	0	20.6	1.4	22.0	188.3	41.43	19.6	0.4	20.0	282.5	56.50	18.6	0.4	19.0	376.7	71.57	17.6	0.4	18.0	470.9	84.75
9	A012	ALBERTSDAL	4	0	23.5	1.6	25.0	188.3	47.09	23.5	1.6	25.0	282.5	70.63	22.5	1.6	24.0	376.7	90.40	22.5	1.6	24.0	470.9	113.00
10	A039	FLORENTIA	3	0	12.7	2.3	15.0	188.3	28.25	11.7	2.3	14.0	282.5	39.55	10.7	2.3	13.0	376.7	48.97	10.7	2.3	13.0	470.9	61.21
11	A040	FLORENTIA	3	0	14.8	5.2	20.0	188.3	37.67	13.8	4.2	18.0	282.5	50.85	12.8	4.2	17.0	376.7	64.04	12.8	4.2	17.0	470.9	80.04
12	A041	FLORENTIA	3	0	10.5	2.5	13.0	188.3	24.49	9.5	1.5	11.0	282.5	31.08	8.5	1.5	10.0	376.7	37.67	8.5	1.5	10.0	470.9	47.09
13	A042	FLORENTIA	2	0	10.6	2.4	13.0	188.3	24.49	9.6	1.4	11.0	282.5	31.08	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
14	A043	FLORENTIA	4	1	16.4	1.6	18.0	188.3	33.90	15.4	0.6	16.0	282.5	45.20	14.4	0.6	15.0	376.7	56.50	13.4	0.6	14.0	470.9	65.92
15	A044	FLORENTIA	2	0	11.6	1.4	13.0	188.3	24.49	10.6	1.4	12.0	282.5	33.90	9.6	1.4	11.0	376.7	41.43	9.6	1.4	11.0	470.9	51.79
16	A045	GEN ALBERTSPARK	4	0	13.4	2.6	16.0	188.3	30.13	13.4	1.6	15.0	282.5	42.38	11.4	1.6	13.0	376.7	48.97	11.4	1.6	13.0	470.9	61.21
17	A046	GEN. ALBERTSPARK	5	0	26.9	1.1	28.0	188.3	52.74	25.9	1.1	27.0	282.5	76.28	24.9	1.1	26.0	376.7	97.94	22.9	1.1	24.0	470.9	113.00
18	A047	MAYBERRY PARK	7	3	58.3	5.7	64.0	242.6	155.28	56.3	5.7	62.0	361.8	224.20	52.3	5.7	58.0	475.4	275.70	44.3	5.7	50.0	573.0	286.52
19	A048	MAYBERRY PARK	3	2	14.8	6.2	21.0	188.3	39.55	14.8	6.2	21.0	282.5	59.33	14.8	5.2	20.0	376.7	75.34	14.8	5.2	20.0	470.9	94.17
20	A049	MAYBERRY PARK	4	1	22.9	4.1	27.0	188.3	50.85	22.9	3.1	26.0	282.5	73.45	21.9	3.1	25.0	376.7	94.17	21.9	3.1	25.0	470.9	117.71
21	A050	MAYBERRY PARK	6	4	30.9	0.1	31.0	191.6	59.41	26.9	0.1	27.0	282.5	76.28	25.9	0.1	26.0	376.7	97.94	25.9	0.1	26.0	470.9	122.42
22	A051	RACEVIEW	3	0	9.4	0.6	10.0	188.3	18.83	9.4	0.6	10.0	282.5	28.25	9.4	0.6	10.0	376.7	37.67	9.4	0.6	10.0	470.9	47.09
23	A052	RACEVIEW	2	0	12.6	5.4	18.0	188.3	33.90	12.6	3.4	16.0	282.5	45.20	12.6	3.4	16.0	376.7	60.27	12.6	3.4	16.0	470.9	75.34
24	A065	SOUTH CREST	2	0	8.6	1.4	10.0	188.3	18.83	8.6	1.4	10.0	282.5	28.25	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
25	A066	SOUTH CREST	2	0	9.2	1.8	11.0	188.3	20.72	9.2	0.8	10.0	282.5	28.25	9.2	0.8	10.0	376.7	37.67	9.2	0.8	10.0	470.9	47.09
26	A067	SOUTHCREST	2	0	7.5	9.5	17.0	188.3	32.02	7.5	7.5	15.0	282.5	42.38	7.5	6.5	14.0	376.7	52.74	7.5	6.5	14.0	470.9	65.92
27	A068	VERWOERDPARK	4	0	33.7	1.3	35.0	202.9	71.03	33.7	1.3	35.0	304.4	106.54	32.7	1.3	34.0	400.7	136.24	30.7	1.3	32.0	486.8	155.78
28	A069	VERWOERDPARK	2	0	6.0	7.0	13.0	188.3	24.48	6.0	6.0	12.0	282.5	33.90	6.0	6.0	12.0	376.7	45.20	6.0	6.0	12.0	470.9	56.50
29	A070	VERWOERDPARK	2	0	12.9	2.1	15.0	188.3	28.25	11.9	2.1	14.0	282.5	39.55	11.9	2.1	14.0	376.7	52.74	11.9	2.1	14.0	470.9	65.92
30	A071	VERWOERDPARK	2	0	9.0	2.0	11.0	188.3	20.72	9.0	2.0	11.0	282.5	31.08	9.0	2.0	11.0	376.7	41.43	9.0	2.0	11.0	470.9	51.79
31	A072	VERWOERDPARK	4	2	24.8	3.2	28.0	188.3	52.74	24.8	3.2	28.0	282.5	79.10	24.8	2.2	27.0	376.7	101.70	21.8	2.2	24.0	470.9	113.00
32	A073	VERWOERDPARK	3	0	22.7	2.3	25.0	188.3	47.09	21.7	2.3	24.0	282.5	67.80	21.7	2.3	24.0	376.7	90.40	21.7	2.3	24.0	470.9	113.00
33	A074	VERWOERDPARK	4	2	25.1	0.9	26.0	188.3	48.97	25.1	0.9	26.0	282.5	73.45	25.1	0.9	26.0	376.7	97.94	25.1	0.9	26.0	470.9	122.42
34	A075	VERWOERDPARK	3	0	10.5	24.5	35.0	202.9	71.03	10.5	21.5	32.0	292.1	93.47	10.5	18.5	29.0	376.7	109.24	10.5	14.5	25.0	470.9	117.71
35	A076	VERWOERDPARK	3	0	16.7	0.3	17.0	188.3	32.02	16.7	0.3	17.0	282.5	48.03	16.7	0.3	17.0	376.7	64.04	16.7	0.3	17.0	470.9	80.04
36	A077	VERWOERDPARK	4	1	34.7	21.3	56.0	235.8	132.04	34.7	21.3	56.0	353.7	198.06	34.7	13.3	48.0	453.3	217.59	30.7	13.3	44.0	552.1	242.94
37	A078	VERWOERDPARK	3	1	13.2	3.8	17.0	188.3	32.02	12.2	3.8	16.0	282.5	45.20	11.2	3.8	15.0	376.7	56.50	11.2	3.8	15.0	470.9	70.63
38	A079	VERWOERDPARK	2	0	9.5	3.5	13.0	188.3	24.49	9.5	2.5	12.0	282.5	33.90	8.5	2.5	11.0	376.7	41.43	8.5	2.5	11.0	470.9	51.79
39	A080	VERWOERDPARK	5	0	31.3	3.7	35.0	202.9	71.03	31.3	2.7	34.0	300.5	102.18	30.3	2.7	33.0	395.3	130.44	30.3	2.7	33.0	494.1	163.05
40	A081	VERWOERDPARK	5	3	18.1	1.9	20.0	188.3	37.67	18.1	1.9	20.0	282.5	56.50	18.1	1.9	20.0	376.7	75.34	18.1	1.9	20.0	470.9	94.17
41	A082	VERWOERDPARK	4	1	19.7	1.3	21.0	188.3	39.55	18.7	1.3	20.0	282.5	56.50	18.7	1.3	20.0	376.7	75.34	18.7	1.3	20.0	470.9	94.17
42	A084	VERWOERDPARK	4	0	33.6	6.4	40.0	213.9	85.56	28.6	5.4	34.0	300.5	102.18	25.6	4.4	30.0	376.7	113.00	22.6	4.4	27.0	470.9	127.13
43	A085	FLORENTIA	4	0	22.5	2.5	25.0	188.3	47.09	21.5	2.5	24.0	282.5	67.80	20.5	2.5	23.0	376.7	86.64	17.5	2.5	20.0	470.9	94.17
44	A086	VERWOERDPARK	4	1	20.9	0.1	21.0	188.3	39.55	19.9	0.1	20.0	282.5	56.50	18.9	0.1	19.0	376.7	71.57	18.9	0.1	19.0	470.9	89.46
45	A087	NEW REDRUTH	7	3	28.3	4.7	33.0	197.6	65.22	28.3	2.7	31.0	287.5	89.11	27.3	2.7	30.0	376.7	113.00	27.3	2.7	30.0	470.9	141.26
46	A088	FLORENTIA	4	1	23.5	8.5	32.0	194.7	62.31	23.5	6.5	30.0	282.5	84.75	23.5	4.5	28.0	376.7	105.47	22.5	4.5	27.0	470.9	127.13
47	A089		2	0	16.4	4.6	21.0	188.3	39.55	16.4	2.6	19.0	282.5	53.68	15.4	2.6	18.0	376.7	67.80	15.4	2.6	18.0	470.9	84.75
48	A094	ALBERTON	2	1	6.0	0.0	6.0	188.3	11.30	6.0	0.0	6.0	282.5	16.95	6.0	0.0	6.0	376.7	22.60	6.0	0.0	6.0	470.9	28.25
49	A095	GEN. ALBERTSPARK	5	2	17.8	0.2	18.0	188.3	33.90	17.8	0.2	18.0	282.5	50.85	17.8	0.2	18.0	376.7	67.80	17.8	0.2	18.0	470.9	84.75
50	A096	VERWOERDPARK	4	1	17.3	0.7	18.0	188.3	33.90	16.3	0.7	17.0	282.5	48.03	16.3	0.7	17.0	376.7	64.04	16.3	0.7	17.0	470.9	80.04
51	A101	FLORENTIA	5	0	19.5	3.5	23.0	188.3	43.32	19.5	2.5	22.0	282.5	62.15	18.5	2.5	21.0	376.7	79.10	18.5	2.5	21.0	470.9	98.88
52	A102	GEN. ALBERTSPARK	2	0	10.7	0.3	11.0	188.3	20.72	9.7	0.3	10.0	282.5	28.25	9.7	0.3	10.0	376.7	37.67	9.7	0.3	10.0	470.9	47.09
53	A103	GEN. ALBERTSPARK	4	1	30.0	0.0	30.0	188.3	56.50	29.0	0.0	29.0	282.5	81.93	27.0	0.0	27.0	376.7	101.70	27.0	0.0	27.0	470.9	127.13
54	A104	GEN. ALBERTSPARK	2	0	13.8	0.2	14.0	188.3	26.37	12.8	0.2	13.0	282.5	36.73	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.21
55	A105	GEN. ALBERTS PARK	5	2	16.8	0.2	17.0	188.3	32.02	16.8	0.2	17.0	282.5	48.03	16.8	0.2	17.0	376.7	64.04	16.8	0.2	17.0	470.9	80.04
56	A106	RACEVIEW	4	2	16.4	8.7	25.0	188.3	47.09	16.4	7.7	24.0	282.5	67.80	16.4	6.7	23.0	376.7	86.64	16.4	6.7	23.0	470.9	108.33
57	A108	VERWOERDPARK	7	3	20.9	4.1	25.0	188.3	47.09	20.9	4.1	25.0	282.5	70.63	20.9	4.1	25.0	376.7	94.17	20.9	4.1	25.0	470.9	117.71
58	A109	ALBERTON North	6	2	25.5	37.5	63.0	241.9	152.38	25.5	32.5	58.0	356.5	206.78	25.5	27.5	53.0	460.4	246.65	25.5	22.5	48.0	566.7	271.99
59	A111	NEW REDRUTH	2	0	13.0	4.0	17.0	188.3	32.02	13.0	3.0	16.0	282.5	45.20	13.0	3.0	16.0	376.7	60.27	11.0	3.0	16.0	470.8	75.33

Note: PP = Present price
I = Indoors
O = Outdoors
T = Total
C = Cents
R = Rand

Table H.2

CV Survey Database for Upper Income Group (U)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP+50%)					Water Usage (PP+100%)					Water Usage (PP+150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A001	RANDHART	5	3	13.6	6.4	20.0	188.3	37.67	12.6	6.4	19.0	282.5	53.68	12.6	4.4	17.0	376.7	64.04	12.6	4.4	17.0	470.9	80.04
2	A010	BRACKENHURST	4	1	21.1	1.9	23.0	188.3	43.32	20.1	1.9	22.0	282.5	62.15	20.1	1.9	22.0	376.7	82.87	20.1	1.9	22.0	470.9	103.59
3	A011	BRACKENHURST	6	3	51.7	3.3	55.0	234.8	129.13	51.7	3.3	55.0	352.2	193.70	43.7	3.3	47.0	450.6	211.76	35.7	3.3	39.0	529.8	206.63
4	A013	BRACKENDOWNS	5	2	25.6	2.4	28.0	188.3	52.74	24.6	2.4	27.0	282.5	76.28	21.6	2.4	24.0	376.7	90.40	21.6	2.4	24.0	470.9	113.02
5	A014	BRACKENDOWNS	4	2	26.0	2.0	28.0	188.3	52.74	26.0	2.0	28.0	282.5	79.10	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
6	A015	BRACKENDOWNS	4	1	27.8	2.2	30.0	188.3	56.50	26.8	2.2	29.0	282.5	81.93	26.8	2.2	29.0	376.7	109.24	26.8	2.2	29.0	470.9	136.55
7	A016	BRACKENDOWNS	4	2	12.9	0.1	13.0	188.3	24.48	12.9	0.1	13.0	282.5	36.73	12.9	0.1	13.0	376.7	48.97	12.9	0.1	13.0	470.9	61.21
8	A017	BRACKENDOWNS	4	0	42.8	2.2	45.0	222.4	100.03	34.8	2.2	37.0	311.5	115.26	33.8	2.2	33.0	395.3	130.44	30.8	2.2	33.0	494.1	163.05
9	A018	BRACKENHURST	4	2	19.2	5.8	25.0	188.3	47.09	19.2	3.8	23.0	282.5	64.98	16.2	3.8	20.0	376.7	75.34	16.2	3.8	20.0	470.9	94.17
10	A019	BRACKENDOWNS	5	2	37.0	1.0	38.0	209.9	79.74	35.0	1.0	36.0	308.1	110.90	34.0	1.0	35.0	405.9	142.06	34.0	1.0	35.0	507.4	177.57
11	A020	RANDHART	6	3	41.7	17.3	59.0	238.6	140.76	41.7	15.3	57.0	355.1	202.42	41.7	13.3	55.0	469.6	258.27	40.7	13.3	54.0	584.4	315.57
12	A021	BRACKENHURST	4	1	21.6	5.4	27.0	188.3	50.85	20.6	5.4	26.0	282.5	73.45	20.6	5.4	26.0	376.7	97.94	20.6	5.4	26.0	470.9	122.42
13	A022	BRACKENDOWNS	6	0	39.7	0.3	40.0	213.9	85.56	39.7	0.3	40.0	320.8	128.33	36.7	0.3	37.0	415.4	153.68	33.7	0.3	34.0	509.9	170.31
14	A023	BRACKENDOWNS	6	0	52.9	7.1	60.0	239.4	143.69	52.9	5.1	58.0	356.5	206.78	50.9	5.1	56.0	471.6	264.09	50.9	5.1	56.0	589.5	330.10
15	A024	BRACKENDOWNS	4	2	29.4	0.6	30.0	188.3	56.50	25.4	0.6	26.0	282.5	73.45	20.4	0.6	21.0	376.7	79.10	20.4	0.6	21.0	470.9	98.88
16	A025	BRACKENHURST	5	3	20.7	0.3	21.0	188.3	39.55	20.7	0.3	21.0	282.5	59.33	20.7	0.3	21.0	376.7	79.10	20.7	0.3	21.0	470.9	98.86
17	A026	BRACKENHURST	4	0	20.2	4.9	25.0	188.3	47.09	20.2	3.9	24.0	282.5	67.80	19.2	3.9	23.0	376.7	86.64	19.2	3.9	23.0	470.9	108.30
18	A027	BRACKENHURST	4	1	24.5	9.5	34.0	200.4	68.12	24.5	7.5	32.0	292.1	93.47	21.5	7.5	29.0	376.7	109.24	21.5	6.5	28.0	470.9	131.84
19	A028	BRACKENHURST	2	0	15.1	5.9	22.0	188.3	41.43	14.1	5.9	20.0	282.5	56.50	14.1	4.9	19.0	376.7	71.57	12.1	4.9	17.0	470.5	80.04
20	A029	BRACKENHURST	6	1	45.5	10.5	56.0	235.8	132.04	45.5	8.5	54.0	350.6	189.35	43.5	8.5	52.0	463.2	240.84	41.5	8.5	50.0	573.0	286.52
21	A030	BRACKENHURST	2	0	13.6	0.4	14.0	188.3	26.37	13.6	0.4	14.0	282.5	39.55	11.6	0.4	12.0	376.7	45.20	11.6	0.4	12.0	470.9	56.50
22	A031	BRACKENHURST	5	2	24.1	5.9	30.0	188.3	56.50	24.1	4.9	29.0	282.5	81.93	24.1	3.9	28.0	376.7	105.47	24.1	3.9	28.0	470.9	131.84
23	A032	BRACKENHURST	5	3	29.6	5.4	35.0	202.9	71.03	25.6	4.4	34.0	308.5	102.18	27.6	4.4	32.0	389.5	124.62	26.6	4.4	31.0	479.1	148.52
24	A033	BRACKENHURST	3	0	18.8	38.2	57.0	238.8	134.95	18.8	33.2	52.0	347.4	180.57	18.8	28.2	47.0	450.6	211.78	18.8	23.2	42.0	543.8	228.41
25	A034	BRACKENHURST	4	0	29.1	2.9	32.0	194.7	62.31	24.1	2.9	27.0	282.5	76.28	24.1	1.9	26.0	376.7	97.94	22.1	1.9	24.0	470.9	113.00
26	A035	BRACKENHURST	4	0	23.1	6.9	30.0	188.3	56.50	22.1	6.9	29.0	282.5	81.93	22.1	5.9	28.0	376.7	105.47	22.1	5.9	28.0	470.9	131.84
27	A036	BRACKENHURST	4	2	30.5	1.5	32.0	194.7	62.31	28.5	1.5	30.0	282.5	84.75	26.5	1.5	28.0	376.7	105.47	26.5	1.5	28.0	470.9	131.84
28	A037	BRACKENHURST	4	0	31.5	23.5	55.0	234.8	129.13	31.5	7.5	39.0	317.9	123.97	30.5	7.5	38.0	419.7	159.49	30.5	7.5	38.0	524.6	199.36
29	A038	BRACKENHURST	5	0	25.1	11.9	37.0	207.7	76.84	25.1	9.9	35.0	304.4	106.54	25.1	7.9	33.0	395.3	130.44	25.1	7.9	33.0	494.1	163.05
30	A053	RANDHART	3	1	10.4	6.6	17.0	188.3	32.02	10.4	4.6	15.0	282.5	42.38	10.4	3.6	14.0	376.7	52.74	10.4	3.6	14.0	470.9	65.92
31	A054	RANDHART	3	0	13.8	5.2	19.0	188.3	35.78	13.8	4.2	18.0	282.5	50.85	12.8	3.2	16.0	376.7	60.27	12.8	3.2	16.0	470.9	75.34
32	A055	RANDHART	5	2	27.2	4.8	32.0	194.7	62.31	27.2	2.8	30.0	282.5	84.75	25.2	2.8	28.0	376.7	105.47	25.2	2.8	28.0	470.9	131.84
33	A056	RANDHART	5	3	16.7	8.4	25.0	188.3	47.09	16.7	7.4	24.0	282.5	67.80	16.7	6.4	23.0	376.7	86.64	16.7	6.4	23.0	470.9	108.30
34	A057	RANDHART	7	3	26.7	1.3	28.0	188.3	52.74	26.7	1.3	28.0	282.5	79.10	26.7	1.3	28.0	376.7	105.47	26.7	1.3	28.0	470.9	131.84
35	A058	RANDHART	6	1	32.5	1.5	34.0	200.4	68.12	31.5	1.5	33.0	296.5	97.83	29.5	1.5	31.0	383.3	118.81	29.5	1.5	31.0	479.1	148.52
36	A059	RANDHART	3	0	27.6	7.4	35.0	202.9	71.03	27.6	6.4	34.0	300.5	102.18	24.6	5.4	30.0	376.7	113.00	23.6	5.4	29.0	470.9	136.55
37	A060	RANDHART	6	1	64.4	15.6	80.0	252.2	201.77	64.4	13.6	78.0	376.8	293.94	60.4	13.6	74.0	466.2	368.67	57.4	13.6	71.0	618.6	439.05
38	A061	RANDHART	4	1	27.0	0.0	27.0	188.3	50.85	26.0	0.0	26.0	282.5	73.45	25.0	0.0	25.0	376.7	94.17	25.0	0.0	25.0	470.9	117.71
39	A062	RANDHART	5	2	28.4	3.6	32.0	194.7	62.31	28.4	2.6	31.0	287.5	89.11	27.4	2.6	30.0	376.7	113.00	27.4	2.6	30.0	470.9	141.26
40	A063	RANDHART	4	0	22.0	8.0	30.0	188.3	56.50	22.0	8.0	30.0	282.5	84.75	22.0	6.0	28.0	376.7	105.47	22.0	6.0	28.0	470.9	131.84
41	A064	RANDHART	7	2	36.1	14.9	51.0	230.4	117.51	36.1	11.9	48.0	340.9	163.20	36.1	8.9	45.0	444.8	200.16	33.1	8.9	42.0	543.8	228.41
42	A083	MEYERSDAL	5	2	15.1	9.9	25.0	188.3	47.09	15.1	9.9	25.0	282.5	70.63	15.1	9.9	25.0	376.7	94.17	15.1	9.9	25.0	470.9	117.71
43	A090	MEYERSDAL EXT 21	2	0	13.7	1.3	15.0	188.3	28.25	12.7	1.3	14.0	282.5	39.55	12.7	1.3	14.0	376.7	52.74	12.7	1.3	14.0	470.9	65.92
44	A091	BRACKENDOWNS	3	1	16.0	0.0	16.0	188.3	30.13	16.0	0.0	16.0	282.5	45.20	14.0	0.0	14.0	376.7	52.74	14.0	0.0	14.0	470.9	65.92
45	A092	BRACKENHURST	2	0	13.3	3.7	17.0	188.3	32.02	13.3	3.7	17.0	282.5	48.03	12.3	3.7	16.0	376.7	60.27	12.3	2.7	15.0	470.9	70.63
46	A093	ALBERANTE	3	0	20.0	0.0	20.0	188.3	37.67	20.0	0.0	20.0	282.5	56.50	18.0	0.0	18.0	376.7	67.80	17.0	0.0	17.0	470.9	80.04
47	A097	BRACKENHURST	7	2	20.1	12.9	33.0	197.6	65.22	20.1	10.9	31.0	287.5	89.11	20.1	8.9	29.0	376.7	109.24	20.1	7.9	28.0	470.9	131.84
48	A098	BRACKENHURST	3	0	16.5	3.5	20.0	188.3	37.67	16.5	2.5	19.0	282.5	53.68	15.5	2.5	18.0	376.7	67.80	15.5	2.5	18.0	470.9	84.75
49	A099	BRACKENHURST	2	0	18.7	11.3	30.0	188.3	56.50	14.7	11.3	26.0	282.5	73.45	14.7	10.3	25.0	376.7	94.17	14.7	10.3	25.0	470.9	117.71
50	A107	RANDHART	6	1	39.2	4.8	41.0	215.8	88.48	38.2	2.8	39.0	317.9	123.97	35.2	2.8	38.0	419.7	159.49	35.2	2.8	38.0	524.6	199.36
51	A112	BRACKENDOWNS	2	0	12.5	7.5	20.0	188.3	37.67	12.5	4.5	17.0	282.5	48.03	12.5	4.5	17.0	376.7	64.04	12.5	4.5	17.0	470.8	80.04
52	A113	BRAKENHURST	3	0	17.1	2.9	20.0	188.3	37.67	17.1	2.9	20.0	282.5	56.50	17.1	2.9	20.0	376.7	75.34	17.1	2.9	20.0	470.8	94.17

Note: PP = Present price; I = Indoors; O = Outdoors; T = Total; C = Cents; R = Rand

Table H.3

Water Usage Profile Survey Database for Lower Income Group (L)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kL	%	kL	%	kL	%	kL	%	kL	%	KL	%	kL	%	kL	%	kL	%	kL	%	kL	Equivalent Bill
1	A100	EDEN PARK	6	2	15.5	67.9%	4.7	20.7%	0.7	3.0%	1.1	4.6%	0.6	2.7%	22.6	99.0%	0.0	0.0%	0.2	1.0%	0.0	0.0%	0.2	1.0%	23	R 43.32
2	A110	EDEN PARK	7	2	20.5	76.3%	4.5	16.6%	0.7	2.5%	0.8	2.9%	0.4	1.5%	26.8	100%	0.0	0.0%	0.1	0.3%	0.0	0.0%	0.1	0.3%	27	R 50.85
3	T01	Thokoza	2	0	4.1	44.6%	0.4	4.3%	2.3	25.7%	0.6	6.7%	0.3	3.3%	7.7	84.6%	1.4	15.4%	0.0	0.0%	0.0	0.0%	1.4	15.4%	9	R 16.95
4	T02	Thokoza	3	1	8.7	62.7%	1.8	12.9%	1.6	11.2%	0.8	6.0%	0.3	2.2%	13.2	95.0%	0.4	2.8%	0.0	0.0%	0.3	2.2%	0.7	5.0%	14	R 26.37
5	T03	Thokoza	8	3	28.3	79.2%	2.2	6.2%	0.2	0.5%	0.8	2.2%	0.0	0.0%	31.5	88.2%	2.4	6.8%	0.0	0.0%	1.8	5.0%	4.2	11.8%	36	R 73.93
6	T04	Thokoza	14	6	4.6	17.3%	0.9	3.5%	19.4	72.6%	0.8	2.9%	0.1	0.3%	25.8	96.6%	0.4	1.5%	0.5	1.9%	0.0	0.0%	0.9	3.4%	27	R 50.85
7	T05	Thokoza	9	4	15.5	51.8%	2.3	7.7%	7.3	24.4%	1.1	3.7%	0.6	2.0%	26.8	89.7%	0.4	1.4%	1.4	4.6%	1.3	4.3%	3.1	10.3%	30	R 56.50
8	T06	Thokoza	7	3	2.6	38.7%	2.3	34.7%	1.0	15.7%	0.5	7.7%	0.2	3.3%	6.7	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	7	R 13.18
9	T07	Thokoza	5	3	8.4	53.4%	2.9	18.7%	1.6	10.0%	0.6	4.1%	0.2	1.1%	13.7	87.3%	1.3	8.2%	0.0	0.0%	0.7	4.5%	2.0	12.7%	16	R 30.13
10	T08	Thokoza	7	4	17.9	76.7%	2.2	9.5%	0.9	3.7%	0.8	3.2%	0.2	0.9%	22.0	94.1%	1.0	4.2%	0.0	0.0%	0.4	1.7%	1.4	5.9%	23	R 43.32
11	T09	Thokoza	8	2	30.9	83.0%	2.1	5.7%	0.8	2.1%	0.9	2.4%	0.0	0.0%	34.7	93.2%	1.6	4.4%	0.0	0.0%	0.9	2.4%	2.5	6.8%	37	R 76.84
12	T10	Thokoza	8	3	29.1	75.4%	2.4	6.2%	3.1	8.1%	0.9	2.3%	0.0	0.0%	35.5	92.0%	1.9	5.0%	0.0	0.0%	1.2	3.0%	3.1	8.0%	39	R 82.65
13	T11	Thokoza	11	1	4.8	34.8%	2.3	16.5%	1.3	9.5%	0.7	4.9%	0.0	0.0%	9.0	65.8%	4.7	34.2%	0.0	0.0%	0.0	0.0%	4.7	34.2%	14	R 26.37
14	T12	Thokoza	6	2	22.8	80.5%	2.5	8.7%	2.1	7.4%	0.8	2.9%	0.2	0.6%	28.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	28	R 52.74
15	T13	Thokoza	4	2	1.7	18.4%	1.8	20.3%	2.5	27.4%	1.4	15.2%	0.3	3.4%	7.6	84.6%	1.0	11.1%	0.0	0.0%	0.4	4.3%	1.4	15.4%	9	R 16.95
16	T14	Thokoza	6	2	13.7	72.8%	2.0	10.6%	2.1	11.0%	0.7	3.6%	0.0	0.0%	18.5	97.9%	0.2	0.9%	0.0	0.0%	0.2	1.2%	0.4	2.1%	19	R 35.78
17	T15	Thokoza	7	3	3.9	40.7%	2.3	24.3%	0.4	4.1%	0.9	9.1%	0.5	5.4%	8.1	83.6%	1.4	15.0%	0.0	0.0%	0.1	1.4%	1.6	16.4%	10	R 18.83
18	T16	Thokoza	6	4	2.7	14.0%	0.5	2.8%	6.3	32.3%	0.4	2.1%	5.7	29.4%	15.6	80.7%	2.0	10.1%	0.7	3.4%	1.1	5.8%	3.7	19.3%	19	R 35.78
19	T17	Thokoza	6	1	2.3	13.9%	3.9	23.0%	1.3	7.8%	0.5	2.8%	1.5	9.1%	9.5	56.5%	6.5	38.5%	0.4	2.6%	0.4	2.3%	7.3	43.5%	17	R 32.02
20	T18	Thokoza	4	2	10.1	45.1%	1.9	8.4%	2.1	9.3%	0.8	3.5%	0.2	0.7%	15.0	66.9%	1.3	5.6%	4.2	18.7%	2.0	8.9%	7.4	33.1%	22	R 41.43
21	T19	Thokoza	10	4	10.5	68.6%	2.1	13.8%	1.6	10.2%	0.7	4.4%	0.2	1.4%	15.0	98.5%	0.2	1.3%	0.0	0.0%	0.0	0.3%	0.2	1.5%	15	R 28.25
22	T20	Thokoza	3	0	17.8	32.6%	3.1	5.6%	4.7	8.6%	1.4	2.5%	9.3	17.0%	36.3	66.3%	3.9	7.1%	4.2	7.7%	10.3	18.9%	18.5	33.7%	55	R 129.13
23	T21	Thokoza	11	5	16.5	36.8%	3.2	7.3%	4.2	9.3%	1.2	2.7%	0.8	1.8%	25.9	57.9%	13.4	30.0%	3.2	7.1%	2.2	5.0%	18.8	42.1%	45	R 100.08
24	T22	Thokoza	9	5	14.2	61.2%	1.7	7.3%	4.2	18.0%	1.0	4.3%	0.1	0.4%	21.1	91.2%	1.6	6.8%	0.0	0.0%	0.5	2.1%	2.0	8.8%	23	R 43.32
25	T23	Thokoza	5	2	17.8	67.3%	2.5	9.5%	3.1	11.8%	0.8	2.9%	0.0	0.0%	24.2	91.5%	1.3	5.1%	0.0	0.0%	0.9	3.4%	2.2	8.5%	26	R 48.97
26	T24	Thokoza	5	3	15.6	62.6%	1.0	4.1%	3.7	14.6%	0.9	3.5%	0.0	0.0%	21.2	84.7%	2.0	8.0%	0.5	1.8%	1.3	5.4%	3.8	15.3%	25	R 47.09
27	T25	Thokoza	2	1	1.2	9.0%	1.0	7.7%	3.5	26.2%	0.8	6.0%	0.2	1.6%	6.7	50.5%	5.9	44.3%	0.0	0.0%	0.7	5.2%	6.6	49.5%	13	R 24.48
28	T26	Thokoza	7	4	14.8	66.0%	1.0	4.5%	4.2	18.6%	0.8	3.7%	0.4	1.7%	21.2	94.6%	0.4	1.6%	0.4	1.6%	0.5	2.1%	1.2	5.4%	22	R 41.43
29	T27	Thokoza	4	2	5.0	28.5%	1.1	6.2%	3.1	17.9%	1.7	9.6%	0.6	3.1%	11.5	65.3%	4.9	27.8%	0.0	0.0%	1.2	6.9%	6.1	34.7%	18	R 33.90
30	T28	Thokoza	6	3	15.4	76.4%	2.0	9.9%	1.0	5.2%	1.1	5.5%	0.3	1.5%	19.9	98.5%	0.0	0.0%	0.0	0.0%	0.3	1.5%	0.3	1.5%	20	R 37.67
31	T29	Thokoza	6	2	16.9	67.7%	2.4	9.5%	1.6	6.3%	1.3	5.2%	0.0	0.0%	22.2	88.7%	0.9	3.5%	0.6	2.3%	1.4	5.6%	2.8	11.3%	25	R 47.09
32	T30	Thokoza	7	4	25.4	76.1%	3.3	9.9%	1.6	4.7%	1.0	2.9%	0.2	0.7%	31.4	94.3%	1.2	3.7%	0.0	0.0%	0.7	2.0%	1.9	5.7%	33	R 65.22
33	T31	Thokoza	4	3	12.7	51.7%	2.5	10.2%	1.6	6.3%	1.8	7.1%	0.2	0.9%	18.8	76.2%	5.9	23.8%	0.0	0.0%	0.0	0.0%	5.9	23.8%	25	R 47.09
34	T32	Thokoza	5	2	16.2	72.1%	3.0	13.4%	1.6	7.0%	0.8	3.4%	0.1	0.3%	21.6	96.2%	0.8	3.5%	0.0	0.0%	0.1	0.3%	0.8	3.8%	22	R 41.43
35	T33	Thokoza	6	4	6.0	51.0%	0.4	3.3%	1.6	13.4%	0.2	1.9%	0.5	4.5%	8.7	74.0%	2.2	18.4%	0.8	7.0%	0.1	0.7%	3.0	26.0%	12	R 22.60
36	T34	Thokoza	14	0	11.5	35.6%	3.7	11.5%	1.0	3.0%	2.1	6.5%	0.9	2.7%	19.1	59.3%	10.6	32.7%	2.5	7.7%	0.1	0.3%	13.1	40.7%	32	R 62.31
37	T35	Thokoza	4	2	4.0	52.8%	0.4	5.7%	1.0	13.8%	0.2	2.4%	0.3	4.0%	5.9	78.7%	1.2	15.6%	0.0	0.0%	0.4	5.7%	1.6	21.3%	8	R 15.07
38	T36	Thokoza	6	3	9.9	70.2%	1.9	13.3%	1.0	7.4%	0.7	4.8%	0.3	2.2%	13.8	97.8%	0.0	0.0%	0.0	0.0%	0.3	2.2%	0.3	2.2%	14	R 26.37
39	T37	Thokoza	10	6	5.8	31.4%	2.2	11.9%	2.1	11.3%	0.6	3.2%	0.3	1.7%	11.0	59.5%	5.9	32.2%	0.6	3.3%	0.9	5.0%	7.5	40.5%	18	R 33.90
40	T38	Thokoza	8	5	11.9	30.7%	2.5	6.4%	10.2	26.3%	3.1	8.1%	0.7	1.8%	28.3	73.2%	3.9	10.1%	3.5	9.0%	3.0	7.7%	10.4	26.8%	39	R 82.65
41	T40	Thokoza	12	7	3.9	52.1%	2.7	35.5%	0.1	1.7%	0.8	10.6%	0.0	0.0%	7.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	7	R 13.18
42	T41	Thokoza	5	3	16.2	74.8%	2.4	11.2%	1.6	7.2%	1.2	5.4%	0.2	0.8%	21.5	99.4%	0.0	0.0%	0.0	0.0%	0.1	0.6%	0.1	0.6%	22	R 41.43
43	T42	Thokoza	3	0	1.6	47.0%	0.8	24.9%	0.3	7.9%	0.4	12.0%	0.2	4.6%	3.2	96.3%	0.0	1.3%	0.0	0.0%	0.1	2.4%	0.1	3.7%	3	R 5.65
44	T43	Thokoza	4	2	1.3	37.4%	1.9	54.9%	0.0	0.0%	0.2	6.4%	0.0	1.3%	3.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	3	R 5.65
45	T44	Thokoza	8	4	5.9	33.5%	3.5	20.1%	3.1	17.9%	1.0	5.8%	0.2	0.9%	13.7	78.2%	3.5	20.1%	0.0	0.0%	0.3	1.7%	3.8	21.8%	18	R 33.90
46	T45	Thokoza	7	3	2.2	48.3%	1.4	30.6%	0.1	2.9%	0.8	18.2%	0.0	0.0%	4.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	4	R 7.53
47	T46	Thokoza	6	2	2.1	19.2%	2.2	20.3%	2.1	19.0%	0.7	6.8%	0.1	0.8%	7.2	66.1%	1.4	12.5%	2.3	21.4%	0.0	0.0%	3.7	33.9%	11	R 20.72
48	T47	Thokoza	7	3	2.6	32.3%	2.7	32.9%	0.2	2.0%	0.7	8.6%	0.1	1.1%	6.3	76.9%	0.0	0.0%	0.0	0.0%	1.9	23.1%	1.9	23.1%	8	R 15.07
49	T48	Thokoza	8	3	3.1	38.6%	2.5	31.9%	0.2	2.5%	0.7	9.0%	0.0	0.0%	6.5	82.0%	0.0	0.0%	0.0	0.0%	1.4	18.0%	1.4	18.0%	8	R 15.07
50	T49	Thokoza	2	0	7.7	21.8%	1.1	3.1%	16.4	46.2%	1.6	4.4%	0.2	0.4%	27.0	75.9%	0.8	2.2%	3.9	11.0%	3.9	10.9%	8.6	24.1%	36	R 71.03

Table D.1

Water Usage Profile Survey Database for Middle Income Group (M)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	Equivalent Bill
1	A002	MAYBERRY PARK	5	2	32.4	78.7%	5.5	13.3%	0.8	2.0%	0.9	2.1%	0.9	2.2%	40.5	98.3%	0.3	0.7%	0.0	0.0%	0.4	1.0%	0.7	1.7%	41.2	R 88.46
2	A003	ALBERTON NORTH	5	0	26.0	71.4%	2.7	7.5%	0.9	2.6%	2.3	6.4%	0.1	0.2%	32.0	88.1%	3.7	10.2%	0.6	1.6%	0.0	0.0%	4.3	11.9%	36.4	R 73.93
3	A004	FLORENTIA	3	0	11.4	75.6%	1.4	9.1%	0.2	1.4%	0.9	6.0%	0.1	0.4%	13.9	92.4%	0.4	2.6%	0.0	0.3%	0.7	4.7%	1.1	7.6%	15.1	R 28.25
4	A005	ALBERTON NOORD	5	1	14.1	65.5%	5.5	25.4%	0.9	4.3%	0.7	3.3%	0.1	0.2%	21.3	98.7%	0.0	0.0%	0.0	0.1%	0.3	1.2%	0.3	1.3%	21.6	R 41.43
5	A006	ALBERTON NORTH	6	2	19.2	70.3%	3.9	14.2%	0.5	1.9%	1.0	3.7%	0.0	0.1%	24.6	90.2%	2.3	8.6%	0.3	1.1%	0.0	0.1%	2.7	9.8%	27.3	R 50.85
6	A007	ALBERTON NORTH	3	1	13.2	57.7%	1.9	8.4%	0.7	2.9%	0.6	2.5%	0.0	0.2%	16.4	71.7%	4.7	20.5%	0.0	0.2%	1.8	7.7%	6.5	28.3%	22.9	R 43.32
7	A008	ALBERTSDAL	1	0	5.0	62.5%	0.7	8.3%	0.5	6.1%	0.6	7.2%	0.5	6.0%	7.2	90.0%	0.8	9.7%	0.0	0.2%	0.0	0.0%	0.8	10.0%	8.0	R 15.07
8	A009	ALBERTSDAL	2	0	5.6	49.4%	3.8	33.1%	0.3	2.5%	0.8	7.2%	0.2	1.5%	10.6	93.7%	0.6	5.2%	0.1	0.9%	0.0	0.3%	0.7	6.3%	11.3	R 20.72
9	A012	ALBERTSDAL	4	0	16.4	65.3%	4.5	17.9%	0.8	3.2%	1.5	6.0%	0.4	1.4%	23.6	93.8%	0.4	1.6%	0.0	0.0%	1.2	4.7%	1.6	6.2%	25.2	R 47.09
10	A039	FLORENTIA	3	0	9.8	64.1%	2.5	16.6%	0.1	0.5%	0.5	3.2%	0.0	0.2%	13.0	84.5%	1.8	11.5%	0.0	0.0%	0.6	4.1%	2.4	15.5%	15.4	R 28.25
11	A040	FLORENTIA	3	0	10.2	51.7%	3.2	16.5%	0.4	2.0%	0.7	3.6%	0.0	0.1%	14.6	73.8%	4.7	23.8%	0.1	0.3%	0.4	2.1%	5.2	26.2%	19.7	R 37.67
12	A041	FLORENTIA	3	0	7.8	52.5%	3.3	22.2%	0.2	1.5%	0.5	3.5%	0.2	1.1%	12.0	80.8%	2.3	15.9%	0.5	3.2%	0.0	0.1%	2.8	19.2%	14.8	R 28.25
13	A042	FLORENTIA	2	0	7.6	57.6%	2.2	16.6%	0.2	1.7%	0.7	5.0%	0.0	0.4%	10.7	81.3%	2.3	17.8%	0.1	0.7%	0.0	0.1%	2.5	18.7%	13.2	R 24.48
14	A043	FLORENTIA	4	1	12.8	69.2%	2.7	14.8%	0.8	4.4%	0.4	2.3%	0.1	0.4%	16.8	91.2%	1.2	6.4%	0.0	0.0%	0.4	2.4%	1.6	8.8%	18.5	R 33.90
15	A044	FLORENTIA	2	0	8.4	63.8%	2.0	14.9%	0.3	2.0%	1.0	7.5%	0.2	1.2%	11.8	89.4%	1.2	8.9%	0.1	0.9%	0.1	0.8%	1.4	10.6%	13.2	R 24.48
16	A045	GEN ALBERTSPARK	4	0	15.7	67.0%	3.1	13.3%	0.4	1.6%	0.4	1.6%	0.1	0.3%	19.6	83.8%	3.7	15.8%	0.0	0.1%	0.1	0.3%	3.8	16.2%	23.4	R 43.32
17	A046	GENL ALBERTSPARK	5	0	17.8	77.8%	3.5	15.1%	0.1	0.4%	0.6	2.7%	0.0	0.1%	22.0	96.1%	0.6	2.6%	0.1	0.6%	0.2	0.8%	0.9	3.9%	22.9	R 43.32
18	A047	MAYBERRY PARK	7	5	51.4	80.8%	5.5	8.6%	0.3	0.5%	0.7	1.1%	0.1	0.1%	58.0	91.1%	4.7	7.4%	1.0	1.5%	0.0	0.0%	5.7	8.9%	63.7	R 155.28
19	A048	MAYBERRY PARK	3	2	9.6	45.7%	4.4	21.0%	0.3	1.3%	0.4	2.0%	0.0	0.2%	14.7	70.3%	3.5	16.8%	0.0	0.2%	2.7	12.7%	6.2	29.7%	21.0	R 39.55
20	A049	MAYBERRY PARK	4	1	17.9	65.6%	2.5	9.0%	0.9	3.4%	1.1	4.0%	0.8	2.9%	23.2	84.9%	2.2	7.9%	0.3	1.0%	1.7	6.3%	4.1	15.1%	27.3	R 50.85
21	A050	MAYBERRY PARK	6	4	26.9	87.4%	1.6	5.3%	0.8	2.6%	1.2	3.8%	0.2	0.6%	30.7	99.8%	0.0	0.0%	0.0	0.0%	0.1	0.2%	0.1	0.2%	30.7	R 59.41
22	A051	RACEVIEW	3	0	15.4	74.5%	2.0	9.6%	0.1	0.6%	1.9	9.3%	0.1	0.3%	19.5	94.2%	1.2	5.7%	0.0	0.1%	0.0	0.0%	1.2	5.8%	20.7	R 39.55
23	A052	RACEVIEW	2	0	5.2	36.1%	4.1	28.7%	0.0	0.2%	0.6	4.5%	0.1	0.5%	10.0	70.0%	4.1	28.7%	0.0	0.3%	0.2	1.1%	4.3	30.0%	14.3	R 26.37
24	A065	SOUTH CREST	2	0	5.3	67.0%	0.8	10.3%	0.0	0.4%	0.6	7.6%	0.0	0.5%	6.9	85.8%	1.1	13.6%	0.0	0.5%	0.0	0.0%	1.1	14.2%	8.0	R 15.07
25	A066	SOUTH CREST	2	0	6.0	52.8%	2.0	17.4%	0.4	3.6%	1.1	9.2%	0.1	0.5%	9.5	83.4%	0.0	0.0%	1.8	15.4%	0.1	1.2%	1.9	16.6%	11.4	R 20.72
26	A067	SOUTHCREST	2	0	8.3	28.8%	2.9	9.9%	0.0	1.5%	1.2	4.1%	0.0	0.1%	12.4	44.3%	15.8	54.7%	0.2	0.7%	0.1	0.2%	16.1	55.7%	28.5	R 54.62
27	A068	VERWOERDPARK	4	0	32.9	82.7%	3.6	9.1%	0.4	1.0%	1.0	2.5%	0.4	1.0%	38.2	96.3%	0.6	1.5%	0.0	0.0%	0.9	2.2%	1.5	3.7%	39.7	R 85.56
28	A069	VERWOERDPARK	2	0	6.4	35.3%	1.1	6.1%	0.1	0.4%	0.6	3.5%	0.2	0.9%	8.3	46.1%	9.4	51.9%	0.0	0.0%	0.3	1.9%	9.7	53.9%	18.1	R 33.90
29	A070	VERWOERDPARK	2	0	8.4	68.5%	1.2	9.5%	0.2	1.3%	0.6	4.6%	0.2	1.8%	10.6	85.7%	1.8	14.3%	0.0	0.0%	0.0	0.0%	1.8	14.3%	12.3	R 22.60
30	A071	VERWOERDPARK	2	0	4.6	42.1%	2.9	26.3%	0.3	2.6%	1.2	10.8%	0.0	0.3%	8.9	82.1%	0.8	7.2%	0.1	0.8%	1.1	9.9%	1.9	17.9%	10.8	R 20.72
31	A072	VERWOERDPARK	4	2	21.1	75.0%	2.7	9.7%	0.4	1.3%	0.6	2.2%	0.1	0.5%	25.0	88.7%	2.3	8.3%	0.2	0.8%	0.6	2.2%	3.2	11.3%	28.2	R 52.74
32	A073	VERWOERDPARK	3	0	14.2	73.4%	1.8	9.3%	0.3	1.7%	1.1	5.7%	0.2	0.8%	17.6	90.9%	0.0	0.0%	0.0	0.0%	1.8	9.1%	1.8	9.1%	19.3	R 35.78
33	A074	VERWOERDPARK	4	2	20.1	78.5%	2.4	9.5%	0.6	2.2%	1.2	4.9%	0.3	1.3%	24.6	96.4%	0.6	2.3%	0.3	1.1%	0.1	0.2%	0.9	3.6%	25.6	R 48.97
34	A075	VERWOERDPARK	3	0	5.6	15.9%	3.3	9.3%	0.7	1.9%	0.9	2.5%	0.2	0.5%	10.7	30.1%	24.6	69.5%	0.0	0.0%	0.1	0.3%	24.8	69.9%	35.4	R 71.03
35	A076	VERWOERDPARK	3	0	11.9	64.1%	4.1	22.2%	0.8	4.5%	1.2	6.6%	0.1	0.6%	18.2	98.0%	0.2	1.2%	0.2	0.9%	0.0	0.0%	0.4	2.0%	18.5	R 35.78
36	A077	VERWOERDPARK	4	1	25.6	45.8%	5.5	9.8%	0.9	1.7%	2.4	4.3%	0.2	0.4%	34.6	62.0%	18.8	33.7%	0.0	0.0%	2.4	4.3%	21.2	38.0%	55.8	R 132.04
37	A078	VERWOERDPARK	3	1	9.6	55.6%	2.3	13.3%	0.1	0.8%	1.2	6.9%	0.2	1.1%	13.4	77.7%	0.0	0.0%	0.2	1.3%	3.6	21.1%	3.8	22.3%	17.2	R 32.02
38	A079	VERWOERDPARK	2	0	6.4	50.7%	2.2	17.4%	0.2	1.7%	0.3	2.2%	0.1	0.9%	9.2	73.0%	2.9	23.3%	0.1	1.0%	0.3	2.8%	3.4	27.0%	12.6	R 24.48
39	A080	VERWOERDPARK	5	0	17.8	69.4%	3.9	15.3%	0.2	0.8%	0.9	3.5%	0.1	0.5%	22.9	89.5%	2.3	9.2%	0.3	1.1%	0.1	0.2%	2.7	10.5%	25.6	R 48.97
40	A081	VERWOERDPARK	5	3	14.1	70.1%	3.1	15.5%	0.3	1.4%	0.6	3.0%	0.1	0.7%	18.3	90.7%	0.0	0.0%	0.1	0.4%	1.8	8.9%	1.9	9.3%	20.2	R 37.67
41	A082	VERWOERDPARK	4	1	16.4	77.3%	2.6	12.2%	0.1	0.4%	0.8	3.7%	0.0	0.1%	19.9	93.8%	0.0	0.0%	0.0	0.0%	1.3	6.2%	1.3	6.2%	21.2	R 39.55
42	A084	VERWOERDPARK	4	0	23.7	71.8%	2.4	7.2%	0.4	1.1%	0.9	2.8%	0.4	1.1%	27.8	84.1%	2.8	8.3%	0.0	0.0%	2.5	7.6%	5.3	15.9%	33.0	R 65.22
43	A085	FLORENTIA	4	0	15.6	61.9%	4.4	17.3%	0.5	1.8%	2.0	7.9%	0.3	1.1%	22.7	89.9%	0.2	0.8%	0.4	1.7%	1.9	7.6%	2.5	10.1%	25.3	R 47.09
44	A086	VERWOERDPARK	4	1	16.4	79.0%	2.7	13.2%	0.7	3.5%	0.4	2.0%	0.3	1.7%	20.7	99.4%	0.0	0.0%	0.0	0.0%	0.1	0.6%	0.1	0.6%	20.8	R 39.55
45	A087	NEW REDRUTH	7	3	22.0	66.4%	4.4	13.2%	1.5	4.4%	0.5	1.6%	0.1	0.3%	28.4	85.8%	4.7	14.2%	0.0	0.0%	0.0	0.0%	4.7	14.2%	33.1	R 65.22
46	A088	FLORENTIA	4	1	16.4	51.0%	2.7	8.5%	0.7	2.2%	1.9	5.9%	1.8	5.7%	23.6	73.3%	8.2	25.5%	0.2	0.6%	0.2	0.6%	8.6	26.7%	32.2	R 62.31
47	A089		2	0	12.5	59.3%	2.9	13.6%	0.1	0.4%	0.8	3.9%	0.2	0.8%	16.5	78.0%	4.3	20.4%	0.3	1.3%	0.1	0.3%	4.6	22.0%	21.1	R 39.55
48	A094	ALBERTON NORTH	2	1	4.6	71.0%	1.2	18.2%	0.1	0.8%	0.5	8.3%	0.1	1.7%	6.4	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	6.4	R 11.30
49	A095	GENL ALBERTSPARK	5	2	14.1	79.4%	2.2	12.3%	0.4	2.3%	0.7	3.8%	0.2	0.9%	17.6	98.7%	0.0	0.0%	0.2	1.3%	0.0	0.0%	0.2	1.3%	17.8	R 33.90
50	A096	VERWOERDPARK	4	1	12.8	70.6%	2.2	12.1%	0.4	2.3%	1.4	7.7%	0.6	3.4%	17.4	96.1%	0.6	3.2%	0.1	0.7%	0.0	0.0%	0.7	3.9%	18.1	R 33.90
51	A101	FLORENTIA	5	0	13.2	56.3%	5.2	22.0%	0.5	2.1%	0.9	3.9%	0.1	0.4%	19.9	84.7%	2.3	10.0%	1.2	5.2%	0.0	0.1%	3.6	15.3%	23.4	R 43.32
52	A102	GENL ALBERTSPARK	2	0	12.8	71.8%	3.3	18.5%	0.4	2.1%	0.8	4.7%	0.0	0.3%	17.3	97.4%	0.4	2.2%	0.0	0.2%	0.0	0.1%	0.5	2.6%	17.8	R 33.90
53	A103	GENL ALBERTSPARK	4	1	21.9	72.6%	5.5	18.2%	1.5	4.8%	1.0	3.4%	0.3	1.0%	30.2	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	30.2	R 56.50
54	A104	GENL ALBERTSPARK	2	0	10.0	73.0%	2.2	15.9%	0.4	2.8%	0.8	6.2%	0.1	0.9%	13.6	98.9%	0.0	0.0%	0.0	0.0%	0.2	1.1%	0.2	1.1%	13.7	R 26.37
55	A105	GENL ALBERTS PARK	5	2	10.0	60.1%	5.6	33.7%	0.5	2.9%	0.3	1.9%	0.0	0.0%	16.5	98.6%	0.0	0.0%	0.2	1.4%	0.0	0.0%	0.2	1.4%	16.7	R 32.02
56	A106	RACEVIEW	4	2	9.4	45.6%	2.8	13.5%	0.6	2.7%	0.5	2.7%	0.2	0.9%	13.5	65.4%	7.0	34.2%	0.1	0.4%	0.0	0.0%	7.1	34.6%	20.6	R 39.55
57	A108	VERWOERDPARK	7	3	15.1	59.1%	5.0	19.7%	0.5	1.9%	0.5	1.9%	0.2	0.9%	21.3	83.6%	3.9	15.3%	0.3	1.0%	0.0	0.0%	4.2	16.4%	25.5	R 47.09
58	A109	ALBERTON NORTH	6	2	17.9	28.1%	4.4	7.0%	0.6	0.9%	1.0	1.5%	1.8	2.9%	25.6	40.4%	32.9	51.8%	0.2	0.3%	4.7	7.5%	37.8	59.6%	63.5	R 152.38
59	A111	NEW REDRUTH	2	0	8.1	48.1%	2.2	13.0%	1.6	9.3%	0.8	4.7%	0.3	1.5%	12.9	76.7%	3.7	22.1%	0.0	0.0%	0.2	1.3%	3.9	23.3%	16.8	R 32.02

Table D.2

Water Usage Profile Survey Database for Upper Income Group (U)

No.	Respond. No.	Township	No of Persons		Monthly Indoor Water Usage												Monthly Outdoor Water Usage								Total Monthly Water Usage	
			Total	No of Children	Bathroom		Toilet		Laundry		Kitchen		Other		Sub-Total		Garden		Car		Other		Sub-Total			
					kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	%	kL	Equivalent Bill
1	A001	RANDHART	5	3	11.5	49.5%	2.3	9.8%	0.7	3.0%	1.0	4.3%	0.3	1.1%	15.8	67.8%	7.0	30.2%	0.0	0.0%	0.5	2.0%	7.5	32.2%	23	R 43.32
2	A010	BRACKENHURST	4	1	15.8	68.0%	3.8	16.5%	0.9	4.0%	0.7	2.9%	0.1	0.3%	21.3	91.7%	0.6	2.5%	0.1	0.6%	1.2	5.1%	1.9	8.3%	23	R 43.32
3	A011	BRACKENHURST	6	3	20.7	70.9%	4.5	15.4%	0.8	2.7%	1.1	3.9%	0.3	1.1%	27.5	94.0%	0.5	1.6%	0.0	0.0%	1.3	4.4%	1.8	6.0%	29	R 54.62
4	A013	BRACKENDOWNS	5	2	18.2	65.0%	5.5	19.6%	1.1	3.8%	0.9	3.1%	0.0	0.1%	25.6	91.6%	0.8	2.8%	0.0	0.0%	1.6	5.6%	2.3	8.4%	28	R 52.74
5	A014	BRACKENDOWNS	4	2	26.6	71.6%	5.6	15.0%	0.4	1.0%	2.0	5.3%	0.1	0.2%	34.6	93.0%	0.6	1.6%	0.2	0.5%	1.8	4.9%	2.6	7.0%	37	R 76.84
6	A015	BRACKENDOWNS	4	1	12.8	59.2%	4.1	19.0%	0.8	3.7%	1.1	5.1%	1.2	5.6%	20.0	92.7%	0.0	0.0%	0.2	0.9%	1.4	6.3%	1.6	7.3%	22	R 41.43
7	A016	BRACKENDOWNS	4	2	11.7	74.0%	2.5	15.8%	0.4	2.4%	1.0	6.5%	0.1	0.8%	15.8	99.4%	0.0	0.0%	0.0	0.3%	0.1	0.3%	0.1	0.6%	16	R 30.13
8	A017	BRACKENDOWNS	4	0	29.4	79.2%	4.5	12.1%	0.3	0.7%	1.1	3.0%	0.1	0.2%	35.3	95.2%	0.5	1.3%	0.0	0.0%	1.3	3.5%	1.8	4.8%	37	R 76.84
9	A018	BRACKENHURST	4	2	16.4	55.3%	4.0	13.4%	0.7	2.2%	1.7	5.8%	0.0	0.2%	22.9	76.9%	4.6	15.5%	0.3	1.0%	2.0	6.7%	6.9	23.1%	30	R 56.50
10	A019	BRACKENDOWNS	5	2	29.3	76.6%	5.8	15.2%	1.4	3.5%	0.6	1.6%	0.1	0.4%	37.2	97.3%	0.0	0.0%	1.0	2.5%	0.1	0.2%	1.0	2.7%	38	R 79.74
11	A020	RANDHART	6	3	30.1	51.2%	7.4	12.6%	1.6	2.7%	1.5	2.5%	1.0	1.7%	41.6	70.7%	12.3	20.9%	1.9	3.3%	3.0	5.1%	17.2	29.3%	59	R 140.76
12	A021	BRACKENHURST	4	1	10.7	46.8%	5.5	24.0%	0.9	4.1%	1.1	5.0%	0.0	0.2%	18.3	80.1%	0.8	3.4%	0.0	0.0%	3.8	16.5%	4.6	19.9%	23	R 43.32
13	A022	BRACKENDOWNS	6	0	22.8	76.1%	3.3	11.0%	0.7	2.5%	2.0	6.7%	0.9	3.1%	29.8	99.3%	0.0	0.0%	0.2	0.6%	0.0	0.1%	0.2	0.7%	30	R 56.50
14	A023	BRACKENDOWNS	6	0	15.1	62.4%	3.3	13.6%	1.1	4.7%	1.2	4.9%	0.7	2.7%	21.3	88.2%	1.2	4.9%	0.3	1.1%	1.4	5.8%	2.8	11.8%	24	R 45.20
15	A024	BRACKENDOWNS	4	2	14.6	71.7%	3.9	19.0%	0.1	0.7%	1.1	5.3%	0.3	1.3%	20.0	98.0%	0.3	1.4%	0.0	0.2%	0.1	0.3%	0.4	2.0%	20	R 37.67
16	A025	BRACKENHURST	5	3	12.4	60.3%	6.3	30.3%	0.6	2.7%	1.0	4.9%	0.1	0.5%	20.4	98.7%	0.0	0.0%	0.2	1.2%	0.0	0.1%	0.3	1.3%	21	R 39.55
17	A026	BRACKENHURST	4	0	14.6	58.3%	3.3	13.1%	0.6	2.3%	1.4	5.5%	0.4	1.5%	20.2	80.6%	2.3	9.3%	0.0	0.0%	2.5	10.0%	4.9	19.4%	25	R 47.09
18	A027	BRACKENHURST	4	1	16.6	49.6%	5.2	15.5%	1.0	3.0%	1.0	3.0%	0.3	0.8%	24.1	72.0%	7.0	21.0%	0.0	0.0%	2.4	7.1%	9.4	28.0%	34	R 68.12
19	A028	BRACKENHURST	2	0	11.1	51.7%	2.6	12.2%	0.3	1.3%	1.6	7.7%	0.0	0.2%	15.7	73.1%	1.8	8.2%	0.2	1.2%	3.8	17.6%	5.8	26.9%	22	R 41.43
20	A029	BRACKENHURST	6	1	15.5	60.8%	3.1	12.3%	0.7	2.6%	1.0	3.9%	0.4	1.6%	20.7	81.2%	1.8	6.9%	0.6	2.4%	2.4	9.5%	4.8	18.8%	26	R 48.97
21	A030	BRACKENHURST	2	0	10.0	73.7%	2.2	16.1%	0.2	1.8%	0.7	4.9%	0.1	0.5%	13.2	97.0%	0.1	0.5%	0.3	2.2%	0.0	0.4%	0.4	3.0%	14	R 26.37
22	A031	BRACKENHURST	5	2	12.9	49.9%	5.5	21.2%	0.6	2.3%	1.5	5.6%	0.4	1.4%	20.8	80.4%	4.7	18.2%	0.2	0.6%	0.2	0.8%	5.1	19.6%	26	R 48.97
23	A032	BRACKENHURST	5	3	25.1	71.2%	2.7	7.8%	0.4	1.1%	1.2	3.5%	0.3	1.0%	29.8	84.5%	4.7	13.3%	0.1	0.4%	0.6	1.8%	5.5	15.5%	35	R 71.03
24	A033	BRACKENHURST	3	0	11.8	20.9%	5.5	9.7%	0.2	0.4%	0.8	1.5%	0.3	0.5%	18.7	33.0%	32.9	58.1%	0.0	0.1%	4.9	8.8%	37.8	67.0%	57	R 134.95
25	A034	BRACKENHURST	4	0	20.8	65.4%	6.3	19.7%	0.5	1.6%	1.4	4.4%	0.0	0.1%	29.0	91.0%	2.3	7.4%	0.2	0.5%	0.3	1.1%	2.9	9.0%	32	R 62.31
26	A035	BRACKENHURST	4	0	11.4	49.1%	5.0	21.7%	1.0	0.0%	0.4	1.8%	0.0	0.2%	17.9	72.8%	1.6	6.7%	0.1	0.4%	3.7	15.9%	5.3	23.0%	23	R 43.32
27	A036	BRACKENHURST	4	2	25.6	79.2%	3.5	10.9%	0.6	1.9%	1.1	3.4%	0.0	0.1%	30.8	95.4%	0.0	0.0%	0.2	0.8%	1.2	3.8%	1.5	4.6%	32	R 62.31
28	A037	BRACKENHURST	4	0	22.8	41.3%	5.9	10.7%	0.1	0.3%	2.3	4.2%	0.4	0.8%	31.6	57.2%	18.8	34.0%	0.2	0.3%	4.7	8.5%	23.7	42.8%	55	R 129.13
29	A038	BRACKENHURST	5	0	17.8	48.8%	5.5	15.0%	0.5	1.5%	0.6	1.7%	0.3	0.9%	24.8	67.9%	9.4	25.7%	0.0	0.0%	2.3	6.4%	11.7	32.1%	37	R 76.84
30	A053	RANDHART	3	1	6.6	38.7%	2.7	15.6%	0.7	4.3%	0.3	1.9%	0.1	0.4%	10.4	61.0%	6.5	38.0%	0.1	0.5%	0.1	0.5%	6.6	39.0%	17	R 32.02
31	A054	RANDHART	3	0	10.6	55.9%	2.1	11.1%	0.5	2.5%	0.2	1.2%	0.4	1.9%	13.8	72.8%	4.7	24.7%	0.3	1.4%	0.2	1.1%	5.2	27.2%	19	R 35.78
32	A055	RANDHART	5	2	21.4	66.8%	4.1	12.8%	0.2	0.6%	0.9	2.7%	0.7	2.0%	27.3	84.9%	4.7	14.6%	0.2	0.5%	0.0	0.0%	4.9	15.1%	32	R 62.31
33	A056	RANDHART	5	3	14.2	56.5%	1.6	6.5%	0.3	1.0%	0.6	2.2%	0.1	0.4%	16.8	66.6%	3.5	14.0%	0.2	0.7%	4.7	18.7%	8.4	33.4%	25	R 47.09
34	A057	RANDHART	7	3	19.8	70.2%	4.8	17.2%	0.6	2.1%	1.6	5.8%	0.1	0.4%	26.9	95.5%	0.0	0.0%	0.1	0.3%	1.2	4.2%	1.3	4.5%	28	R 52.74
35	A058	RANDHART	6	1	26.5	77.8%	4.4	12.9%	0.5	1.4%	0.7	2.2%	0.5	1.4%	32.5	95.6%	1.4	4.0%	0.0	0.0%	0.1	0.4%	1.5	4.4%	34	R 68.12
36	A059	RANDHART	3	0	17.4	67.2%	1.3	4.8%	0.3	1.2%	1.1	4.3%	0.3	1.3%	20.4	78.8%	3.5	13.6%	0.9	3.4%	1.1	4.2%	5.5	21.2%	26	R 48.97
37	A060	RANDHART	6	1	16.2	53.5%	5.5	18.0%	0.8	2.5%	1.7	5.6%	0.2	0.8%	24.4	80.5%	4.7	15.5%	0.1	0.4%	1.1	3.7%	5.9	19.5%	30	R 56.50
38	A061	RANDHART	4	1	23.7	86.3%	1.7	6.3%	0.5	1.9%	1.2	4.3%	0.3	1.2%	27.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	27	R 50.85
39	A062	RANDHART	5	2	21.4	68.0%	4.5	14.3%	0.5	1.5%	1.1	3.6%	0.4	1.1%	27.9	88.6%	1.8	5.6%	0.0	0.1%	1.8	5.7%	3.6	11.4%	32	R 62.31
40	A063	RANDHART	4	0	17.5	58.6%	3.8	12.6%	0.2	0.7%	0.3	1.2%	0.1	0.3%	21.9	73.3%	4.7	15.7%	0.3	1.0%	3.0	9.9%	8.0	26.7%	30	R 56.50
41	A064	RANDHART	7	2	29.7	57.7%	4.1	8.0%	0.6	1.3%	1.1	2.1%	0.9	1.8%	36.4	70.8%	13.7	26.6%	0.1	0.2%	1.2	2.4%	15.0	29.2%	51	R 117.51
42	A083	MEYERSDAL	5	2	10.5	41.6%	3.0	11.9%	0.4	1.6%	1.1	4.2%	0.3	1.1%	15.3	60.4%	0.0	0.0%	0.0	0.0%	10.0	39.6%	10.0	39.6%	25	R 47.09
43	A090	MEYERSDAL EXT 21	2	0	11.0	72.7%	1.6	10.9%	0.1	0.7%	1.0	6.4%	0.1	0.7%	13.8	91.4%	1.0	6.5%	0.3	2.1%	0.0	0.0%	1.3	8.6%	15	R 28.25
44	A091	BRACKENDOWNS	3	1	10.4	66.0%	4.1	26.1%	0.4	2.6%	0.8	4.8%	0.1	0.5%	15.7	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	16	R 30.13
45	A092	BRACKENHURST	2	0	8.9	51.8%	3.6	20.8%	0.4	2.4%	0.5	3.0%	0.1	0.4%	13.5	78.4%	3.5	20.4%	0.2	1.3%	0.0	0.0%	3.7	21.6%	17	R 32.02
46	A093	ALBERANTE	3	0	8.6	59.6%	4.5	31.0%	0.3	2.4%	0.9	6.2%	0.1	0.7%	14.5	100%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	14	R 26.37
47	A097	BRACKENHURST	7	2	13.2	40.0%	5.2	15.7%	0.5	1.5%	1.2	3.5%	0.1	0.3%	20.2	61.0%	10.6	31.9%	0.0	0.0%	2.3	7.1%	12.9	39.0%	33	R 65.22
48	A098	BRACKENHURST	3	0	8.3	55.9%	3.1	21.1%	0.4	2.8%	0.3	2.2%	0.1	0.6%	12.2	83%	1.2	7.9%	0.2	1.1%	1.2	8.3%	2.6	17.4%	15	R 28.25
49	A099	BRACKENHURST	2	0	7.3	42.5%	2.2	12.8%	0.4	2.1%	0.6	3.8%	0.2	1.1%	10.6	62.3%	4.7	27.5%	0.0	0.0%	1.7	10.2%	6.4	37.7%	17	R 32.02
50	A107	RANDHART	6	1	24.9	60.6%	7.8	18.9%	1.5	3.6%	1.5	3.6%	0.6	1.5%	36.2	88.2%	4.5	11.0%	0.3	0.7%	0.0	0.1%	4.8	11.8%	41	R 88.46
51	A112	BRACKENDOWNS	2	0	8.8	44.4%	2.2	11.0%	0.4	1.8%	1.0	5.1%	0.1	0.3%	12.4	62.6%	7.4	37.4%	0.0	0.0%	0.0	0.0%	7.4	37.4%	20	R 37.67
52	A113	BRAKENHURST	3	0	12.3	62.6%	2.8	14.1%	0.6	2.9%	1.0	5.0%	0.2	1.0%	16.8	85.6%	1.1	5.4%	0.6	3.0%	1.2	6.0%	2.8	14.4%	20	R 37.67

APPENDIX I

Cobra-Tech Water Usage Details

CV Survey Database for Lower Income Group (L)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP+50%)					Water Usage (PP+100%)					Water Usage (PP+150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A100	EDEN PARK	6	2	29.7	0.3	30.0	188.3	56.50	28.7	0.3	29.0	282.5	81.93	28.7	0.3	29.0	376.7	109.24	28.7	0.3	29.0	470.9	136.55
2	A110	EDEN PARK	7	2	37.9	0.1	38.0	209.9	79.74	36.9	0.1	37.0	311.5	115.26	34.9	0.1	35.0	405.9	142.06	34.9	0.1	35.0	507.4	177.57
3	T01	Thokoza	2	0	7.6	1.4	9.0	188.3	16.95	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	4.6	1.4	6.0	470.9	28.25
4	T02	Thokoza	3	1	13.3	0.7	14.0	188.3	26.37	13.3	0.7	14.0	282.5	39.55	12.3	0.7	13.0	376.7	48.97	11.3	0.7	12.0	470.9	56.50
5	T03	Thokoza	8	3	31.8	4.2	36.0	205.4	73.93	31.8	4.2	36.0	308.9	111.19	29.8	4.2	34.0	400.7	136.24	28.8	4.2	33.0	494.1	163.05
6	T04	Thokoza	14	6	26.1	0.9	27.0	188.3	50.85	26.1	0.9	27.0	282.5	76.28	25.1	0.9	26.0	376.7	97.94	24.1	0.9	25.0	470.9	117.71
7	T05	Thokoza	9	4	26.9	3.1	30.0	188.3	56.50	23.9	3.1	27.0	282.5	76.28	21.9	3.1	25.0	376.7	94.17	20.9	3.1	24.0	470.9	113.00
8	T06	Thokoza	7	3	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
9	T07	Thokoza	5	3	14.0	2.0	16.0	188.3	30.13	14.0	2.0	16.0	282.5	45.20	13.0	2.0	15.0	376.7	56.50	12.0	2.0	14.0	470.9	65.92
10	T08	Thokoza	7	4	21.6	1.4	23.0	188.3	43.32	21.6	1.4	23.0	282.5	64.98	21.6	1.4	23.0	376.7	86.64	19.6	1.4	21.0	470.9	98.88
11	T09	Thokoza	8	2	34.5	2.5	37.0	188.3	76.84	34.5	2.5	37.0	311.5	115.26	32.5	2.5	35.0	405.9	142.06	31.5	2.5	34.0	500.9	170.31
12	T10	Thokoza	8	3	35.9	3.1	39.0	188.3	82.65	35.9	3.1	39.0	317.9	123.97	34.9	3.1	38.0	419.7	159.49	33.9	3.1	37.0	519.2	192.10
13	T11	Thokoza	11	1	9.2	4.8	14.0	188.3	26.37	9.2	4.8	14.0	282.5	39.55	8.2	4.8	13.0	376.7	48.97	8.2	3.8	12.0	470.9	56.50
14	T12	Thokoza	6	2	28.0	0.0	28.0	188.3	52.74	28.0	0.0	28.0	282.5	79.10	28.0	0.0	28.0	376.7	105.47	25.0	0.0	25.0	470.9	117.71
15	T13	Thokoza	4	2	7.6	1.4	9.0	188.3	16.95	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	5.6	1.4	7.0	470.9	32.96
16	T14	Thokoza	6	2	18.6	0.4	19.0	188.3	35.78	16.6	0.4	17.0	282.5	48.03	16.6	0.4	17.0	376.7	64.04	14.6	0.4	15.0	470.9	70.63
17	T15	Thokoza	7	3	8.4	1.6	10.0	188.3	18.83	8.4	1.6	10.0	282.5	28.25	7.4	1.6	9.0	376.7	33.90	7.4	0.6	8.0	470.9	37.67
18	T16	Thokoza	6	4	15.3	3.7	19.0	188.3	35.78	15.3	3.7	19.0	282.5	53.68	14.3	3.7	18.0	376.7	67.80	13.3	2.7	16.0	470.9	75.34
19	T17	Thokoza	6	1	9.6	7.4	17.0	188.3	32.02	9.6	7.4	17.0	282.5	48.03	9.6	6.4	16.0	376.7	60.27	8.6	6.4	15.0	470.9	70.63
20	T18	Thokoza	4	2	14.7	7.3	22.0	188.3	41.43	14.7	7.3	22.0	282.5	62.15	12.7	7.3	20.0	376.7	75.34	12.7	5.3	18.0	470.9	84.75
21	T19	Thokoza	10	4	14.8	0.2	15.0	188.3	28.25	14.8	0.2	15.0	282.5	42.38	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.21
22	T20	Thokoza	3	0	32.5	16.5	49.0	228.0	111.70	27.5	16.5	44.0	331.3	145.76	27.5	13.5	41.0	431.5	176.92	27.5	13.5	41.0	539.4	221.15
23	T21	Thokoza	11	5	26.1	18.9	45.0	222.4	100.08	24.1	18.9	43.0	328.9	141.41	24.1	16.9	41.0	431.5	176.92	23.1	16.9	40.0	534.7	213.89
24	T22	Thokoza	9	5	21.0	2.0	23.0	188.3	43.32	20.0	2.0	22.0	282.5	62.15	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
25	T23	Thokoza	5	2	23.8	2.2	26.0	188.3	48.97	21.8	2.2	24.0	282.5	67.80	20.8	2.2	23.0	376.7	86.64	20.8	2.2	23.0	470.9	108.30
26	T24	Thokoza	5	3	21.2	3.8	25.0	188.3	47.09	20.2	3.8	24.0	282.5	67.80	20.2	3.8	24.0	376.7	90.40	20.2	3.8	24.0	470.9	113.00
27	T25	Thokoza	2	1	6.6	6.4	13.0	188.3	24.48	5.6	5.4	11.0	282.5	31.08	5.6	5.4	11.0	376.7	41.43	5.6	5.4	11.0	470.9	51.79
28	T26	Thokoza	7	4	20.8	1.2	22.0	188.3	41.43	20.8	1.2	22.0	282.5	62.15	19.8	1.2	21.0	376.7	79.10	18.8	1.2	20.0	470.9	94.17
29	T27	Thokoza	4	2	11.8	6.2	18.0	188.3	33.90	11.8	6.2	18.0	282.5	50.85	11.8	6.2	18.0	376.7	67.80	10.8	4.2	15.0	470.9	70.63
30	T28	Thokoza	6	3	19.7	0.3	20.0	188.3	37.67	19.7	0.3	20.0	282.5	56.50	17.7	0.3	18.0	376.7	67.80	17.7	0.3	18.0	470.9	84.75
31	T29	Thokoza	6	2	22.2	2.8	25.0	188.3	47.09	22.2	2.8	25.0	282.5	70.63	22.2	2.8	25.0	376.7	94.17	22.2	2.8	25.0	470.9	117.71
32	T30	Thokoza	7	4	25.5	1.5	27.0	188.3	50.85	23.5	1.5	25.0	282.5	70.63	22.5	1.5	24.0	376.7	90.40	22.5	1.5	24.0	470.9	113.00
33	T31	Thokoza	4	3	19.1	6.0	25.0	188.3	47.09	19.1	6.0	25.0	282.5	70.63	19.1	6.0	25.0	376.7	94.17	17.1	6.0	23.0	470.9	108.30
34	T32	Thokoza	5	2	21.2	0.8	22.0	188.3	41.43	21.2	0.8	22.0	282.5	62.15	20.2	0.8	21.0	376.7	79.10	20.2	0.8	21.0	470.9	98.88
35	T33	Thokoza	6	4	8.9	3.1	12.0	188.3	22.60	8.9	3.1	12.0	282.5	33.90	7.9	3.1	11.0	376.7	41.43	6.9	3.1	10.0	470.9	47.09
36	T34	Thokoza	14	0	19.0	13.0	32.0	194.7	62.31	16.0	13.0	31.0	287.5	89.11	18.0	12.0	30.0	376.7	113.00	18.0	11.0	29.0	470.9	136.55
37	T35	Thokoza	4	2	6.3	1.7	8.0	188.3	15.07	6.3	1.7	8.0	282.5	22.60	6.3	1.7	8.0	376.7	30.13	6.3	0.7	7.0	470.9	32.96
38	T36	Thokoza	6	3	13.7	0.3	14.0	188.3	26.37	12.7	0.3	13.0	282.5	36.73	12.7	0.3	13.0	376.7	48.97	11.7	0.3	12.0	470.9	56.50
39	T37	Thokoza	10	6	10.7	7.3	18.0	188.3	33.90	8.7	7.3	16.0	282.5	45.20	8.7	6.3	15.0	376.7	56.50	8.7	5.3	14.0	470.9	65.92
40	T38	Thokoza	8	5	28.5	10.5	39.0	211.9	82.65	26.5	10.5	37.0	311.5	115.26	26.5	9.5	36.0	410.7	147.87	25.5	8.5	34.0	500.9	170.31
41	T40	Thokoza	12	7	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
42	T41	Thokoza	5	3	21.9	0.1	22.0	188.3	41.43	21.9	0.1	22.0	282.5	62.15	20.9	0.1	21.0	376.7	79.10	19.9	0.1	20.0	470.9	94.17
43	T42	Thokoza	3	0	2.9	0.1	3.0	188.3	5.65	2.9	0.1	3.0	282.5	8.48	2.9	0.1	3.0	376.7	11.30	2.9	0.1	3.0	470.9	14.13
44	T43	Thokoza	4	2	3.0	0.0	3.0	188.3	5.65	3.0	0.0	3.0	282.5	8.48	3.0	0.0	3.0	376.7	11.30	3.0	0.0	3.0	470.9	14.13
45	T44	Thokoza	8	4	14.1	3.9	18.0	188.3	33.90	13.1	3.9	17.0	282.5	48.03	12.1	3.9	16.0	376.7	60.27	12.1	2.9	15.0	470.9	70.63
46	T45	Thokoza	7	3	4.0	0.0	4.0	188.3	7.53	4.0	0.0	4.0	282.5	11.30	4.0	0.0	4.0	376.7	15.07	4.0	0.0	4.0	470.9	18.83
47	T46	Thokoza	6	2	7.3	3.7	11.0	188.3	20.72	6.3	3.7	10.0	282.5	28.25	5.3	3.7	9.0	376.7	33.90	4.3	3.7	8.0	470.9	37.67
48	T47	Thokoza	7	3	6.2	1.8	8.0	188.3	15.07	6.2	1.8	8.0	282.5	22.60	4.2	1.8	6.0	376.7	22.60	4.2	0.8	5.0	470.9	23.54
49	T48	Thokoza	8	3	6.6	1.4	8.0	188.3	15.07	6.6	1.4	8.0	282.5	22.60	5.6	1.4	7.0	376.7	26.37	4.6	1.4	6.0	470.9	28.25
50	T49	Thokoza	2	0	27.3	8.7	36.0	205.4	73.93	26.3	8.7	35.0	304.4	106.54	26.3	8.7	35.0	405.9	142.06	25.3	8.7	34.0	500.9	170.31

Note: PP = Present price
I = Indoors
O = Outdoors
T = Total
C = Cents
R = Rand

Table H.1

CV Survey Database for Middle Income Group (M)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP + 50%)					Water Usage (PP + 100%)					Water Usage (PP + 150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A002	MAYBERRY PARK	5	2	40.3	0.7	41.0	215.8	88.46	38.3	0.7	39.0	317.9	123.97	37.3	0.7	38.0	419.7	159.49	37.3	0.7	38.0	524.6	199.36
2	A003	ALBERTON NORTH	5	0	31.7	4.3	36.0	205.4	73.93	30.7	3.3	34.0	300.5	102.18	29.7	2.3	32.0	389.5	124.62	28.7	2.3	31.0	479.1	148.52
3	A004	FLORENTIA	3	0	13.9	1.1	15.0	188.3	28.25	13.9	1.1	15.0	282.5	42.38	11.9	1.1	13.0	376.7	48.97	9.9	1.1	11.0	470.9	51.79
4	A005	ALBERTON NOORD	5	1	21.7	0.3	22.0	188.3	41.43	21.7	0.3	22.0	282.5	62.15	19.7	0.3	20.0	376.7	75.34	17.7	0.3	18.0	470.9	84.75
5	A006	ALBERTON NORTH	6	2	31.6	3.4	35.0	202.9	71.03	31.6	3.4	35.0	304.4	106.54	30.6	1.4	32.0	389.5	124.62	28.6	1.4	30.0	470.9	141.26
6	A007	ALBERTON NORTH	3	1	16.5	6.5	23.0	188.3	43.32	16.5	4.5	21.0	282.5	59.33	15.5	4.5	20.0	376.7	75.34	15.5	4.5	20.0	470.9	94.17
7	A008	ALBERTSDAL	1	0	7.2	0.8	8.0	188.3	15.07	7.2	0.8	8.0	282.5	22.60	6.2	0.8	7.0	376.7	26.37	6.2	0.8	7.0	470.9	32.96
8	A009	ALBERTSDAL	2	0	20.6	1.4	22.0	188.3	41.43	19.6	0.4	20.0	282.5	56.50	18.6	0.4	19.0	376.7	71.57	17.6	0.4	18.0	470.9	84.75
9	A012	ALBERTSDAL	4	0	23.5	1.6	25.0	188.3	47.09	23.5	1.6	25.0	282.5	70.63	22.5	1.6	24.0	376.7	90.40	22.5	1.6	24.0	470.9	113.00
10	A039	FLORENTIA	3	0	12.7	2.3	15.0	188.3	28.25	11.7	2.3	14.0	282.5	39.55	10.7	2.3	13.0	376.7	48.97	10.7	2.3	13.0	470.9	61.21
11	A040	FLORENTIA	3	0	14.8	5.2	20.0	188.3	37.67	13.8	4.2	18.0	282.5	50.85	12.8	4.2	17.0	376.7	64.04	12.8	4.2	17.0	470.9	80.04
12	A041	FLORENTIA	3	0	10.5	2.5	13.0	188.3	24.48	9.5	1.5	11.0	282.5	31.08	8.5	1.5	10.0	376.7	37.67	8.5	1.5	10.0	470.9	47.09
13	A042	FLORENTIA	2	0	10.6	2.4	13.0	188.3	24.48	9.6	1.4	11.0	282.5	31.08	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
14	A043	FLORENTIA	4	1	16.4	1.6	18.0	188.3	33.90	15.4	0.6	16.0	282.5	45.20	14.4	0.6	15.0	376.7	56.50	13.4	0.6	14.0	470.9	65.92
15	A044	FLORENTIA	2	0	11.6	1.4	13.0	188.3	24.48	10.6	1.4	12.0	282.5	33.90	9.6	1.4	11.0	376.7	41.43	9.6	1.4	11.0	470.9	51.79
16	A045	GEN ALBERTSPARK	4	0	13.4	2.6	16.0	188.3	30.13	13.4	1.6	15.0	282.5	42.38	11.4	1.6	13.0	376.7	48.97	11.4	1.6	13.0	470.9	61.21
17	A046	GENL ALBERTSPARK	5	0	26.9	1.1	28.0	188.3	52.74	25.9	1.1	27.0	282.5	76.28	24.9	1.1	26.0	376.7	97.94	22.9	1.1	24.0	470.9	113.00
18	A047	MAYBERRY PARK	7	5	58.3	5.7	64.0	242.6	155.28	56.3	5.7	62.0	361.6	224.20	52.3	5.7	58.0	475.4	275.70	44.3	5.7	50.0	573.0	286.52
19	A048	MAYBERRY PARK	3	2	14.8	6.2	21.0	188.3	39.55	14.8	6.2	21.0	282.5	59.33	14.8	5.2	20.0	376.7	75.34	14.8	5.2	20.0	470.9	94.17
20	A049	MAYBERRY PARK	4	1	22.9	4.1	27.0	188.3	50.85	22.9	3.1	26.0	282.5	73.45	21.9	3.1	25.0	376.7	94.17	21.9	3.1	25.0	470.9	117.71
21	A050	MAYBERRY PARK	6	4	30.9	0.1	31.0	191.6	59.41	26.9	0.1	27.0	282.5	76.28	25.9	0.1	26.0	376.7	97.94	25.9	0.1	26.0	470.9	122.42
22	A051	RACEVIEW	3	0	9.4	0.6	10.0	188.3	18.83	9.4	0.6	10.0	282.5	28.25	9.4	0.6	10.0	376.7	37.67	9.4	0.6	10.0	470.9	47.09
23	A052	RACEVIEW	2	0	12.6	5.4	18.0	188.3	33.90	12.6	3.4	16.0	282.5	45.20	12.6	3.4	16.0	376.7	60.27	12.6	3.4	16.0	470.9	75.34
24	A065	SOUTH CREST	2	0	8.6	1.4	10.0	188.3	18.83	8.6	1.4	10.0	282.5	28.25	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
25	A066	SOUTH CREST	2	0	9.2	1.8	11.0	188.3	20.72	9.2	0.8	10.0	282.5	28.25	9.2	0.8	10.0	376.7	37.67	9.2	0.8	10.0	470.9	47.09
26	A067	SOUTHCREST	2	0	7.5	9.5	17.0	188.3	32.02	7.5	7.5	15.0	282.5	42.38	7.5	6.5	14.0	376.7	52.74	7.5	6.5	14.0	470.9	65.92
27	A068	VERWOERDPARK	4	0	33.7	1.3	35.0	202.9	71.03	33.7	1.3	35.0	304.4	106.54	32.7	1.3	34.0	400.7	136.24	30.7	1.3	32.0	486.8	155.78
28	A069	VERWOERDPARK	2	0	6.0	7.0	13.0	188.3	24.48	6.0	6.0	12.0	282.5	33.90	6.0	6.0	12.0	376.7	45.20	6.0	6.0	12.0	470.9	56.50
29	A070	VERWOERDPARK	2	0	12.9	2.1	15.0	188.3	28.25	11.9	2.1	14.0	282.5	39.55	11.9	2.1	14.0	376.7	52.74	11.9	2.1	14.0	470.9	65.92
30	A071	VERWOERDPARK	2	0	9.0	2.0	11.0	188.3	20.72	9.0	2.0	11.0	282.5	31.08	9.0	2.0	11.0	376.7	41.43	9.0	2.0	11.0	470.9	51.79
31	A072	VERWOERDPARK	4	2	24.8	3.2	28.0	188.3	52.74	24.8	3.2	28.0	282.5	79.10	24.8	2.2	27.0	376.7	101.70	21.8	2.2	24.0	470.9	113.00
32	A073	VERWOERDPARK	3	0	22.7	2.3	25.0	188.3	47.09	21.7	2.3	24.0	282.5	67.80	21.7	2.3	24.0	376.7	90.40	21.7	2.3	24.0	470.9	113.00
33	A074	VERWOERDPARK	4	2	25.1	0.9	26.0	188.3	48.97	25.1	0.9	26.0	282.5	73.45	25.1	0.9	26.0	376.7	97.94	25.1	0.9	26.0	470.9	122.42
34	A075	VERWOERDPARK	3	0	10.5	24.5	35.0	202.9	71.03	10.5	21.5	32.0	292.1	93.47	10.5	18.5	29.0	376.7	109.24	10.5	14.5	25.0	470.9	117.71
35	A076	VERWOERDPARK	3	0	16.7	0.3	17.0	188.3	32.02	16.7	0.3	17.0	282.5	48.03	16.7	0.3	17.0	376.7	64.04	16.7	0.3	17.0	470.9	80.04
36	A077	VERWOERDPARK	4	1	34.7	21.3	56.0	235.8	132.04	34.7	21.3	56.0	353.7	198.06	34.7	13.3	48.0	453.3	217.59	30.7	13.3	44.0	552.1	242.94
37	A078	VERWOERDPARK	3	1	13.2	3.8	17.0	188.3	32.02	12.2	3.8	16.0	282.5	45.20	11.2	3.8	15.0	376.7	56.50	11.2	3.8	15.0	470.9	70.63
38	A079	VERWOERDPARK	2	0	9.5	3.5	13.0	188.3	24.48	9.5	2.5	12.0	282.5	33.90	8.5	2.5	11.0	376.7	41.43	8.5	2.5	11.0	470.9	51.79
39	A080	VERWOERDPARK	5	0	31.3	3.7	35.0	202.9	71.03	31.3	2.7	34.0	300.5	102.18	30.3	2.7	33.0	395.3	130.44	30.3	2.7	33.0	494.1	163.05
40	A081	VERWOERDPARK	5	3	18.1	1.9	20.0	188.3	37.67	18.1	1.9	20.0	282.5	56.50	18.1	1.9	20.0	376.7	75.34	18.1	1.9	20.0	470.9	94.17
41	A082	VERWOERDPARK	4	1	19.7	1.3	21.0	188.3	39.55	18.7	1.3	20.0	282.5	56.50	18.7	1.3	20.0	376.7	75.34	18.7	1.3	20.0	470.9	94.17
42	A084	VERWOERDPARK	4	0	33.6	6.4	40.0	213.9	85.56	28.6	5.4	34.0	300.5	102.18	25.6	4.4	30.0	376.7	113.00	22.6	4.4	27.0	470.9	127.13
43	A085	FLORENTIA	4	0	22.5	2.5	25.0	188.3	47.09	21.5	2.5	24.0	282.5	67.80	20.5	2.5	23.0	376.7	86.64	17.5	2.5	20.0	470.9	94.17
44	A086	VERWOERDPARK	4	1	20.9	0.1	21.0	188.3	39.55	19.9	0.1	20.0	282.5	56.50	18.9	0.1	19.0	376.7	71.57	18.9	0.1	19.0	470.9	89.46
45	A087	NEW REDRUTH	7	3	28.3	4.7	33.0	197.6	65.22	28.3	2.7	31.0	287.5	89.11	27.3	2.7	30.0	376.7	113.00	27.3	2.7	30.0	470.9	141.26
46	A088	FLORENTIA	4	1	23.5	8.5	32.0	194.7	62.31	23.5	6.5	30.0	282.5	84.75	23.5	4.5	28.0	376.7	105.47	22.5	4.5	27.0	470.9	127.13
47	A089		2	0	16.4	4.6	21.0	188.3	39.55	16.4	2.6	19.0	282.5	53.68	15.4	2.6	18.0	376.7	67.80	15.4	2.6	18.0	470.9	84.75
48	A094	ALBERTON	2	1	6.0	0.0	6.0	188.3	11.30	6.0	0.0	6.0	282.5	16.95	6.0	0.0	6.0	376.7	22.60	6.0	0.0	6.0	470.9	28.25
49	A095	GENL ALBERTSPARK	5	2	17.8	0.2	18.0	188.3	33.90	17.8	0.2	18.0	282.5	50.85	17.8	0.2	18.0	376.7	67.80	17.8	0.2	18.0	470.9	84.75
50	A096	VERWOERDPARK	4	1	17.3	0.7	18.0	188.3	33.90	16.3	0.7	17.0	282.5	48.03	16.3	0.7	17.0	376.7	64.04	16.3	0.7	17.0	470.9	80.04
51	A101	FLORENTIA	5	0	19.5	3.5	23.0	188.3	43.32	19.5	2.5	22.0	282.5	62.15	18.5	2.5	21.0	376.7	79.10	18.5	2.5	21.0	470.9	98.88
52	A102	GENL ALBERTSPARK	2	0	10.7	0.3	11.0	188.3	20.72	9.7	0.3	10.0	282.5	28.25	9.7	0.3	10.0	376.7	37.67	9.7	0.3	10.0	470.9	47.09
53	A103	GENL ALBERTSPARK	4	1	30.0	0.0	30.0	188.3	56.50	29.0	0.0	29.0	282.5	81.93	27.0	0.0	27.0	376.7	101.70	27.0	0.0	27.0	470.9	127.13
54	A104	GENL ALBERTSPARK	2	0	13.8	0.2	14.0	188.3	26.37	12.8	0.2	13.0	282.5	36.73	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.21
55	A105	GENL ALBERTS PARK	5	2	16.8	0.2	17.0	188.3	32.02	16.8	0.2	17.0	282.5	48.03	16.8	0.2	17.0	376.7	64.04	16.8	0.2	17.0	470.9	80.04
56	A106	RACEVIEW	4	2	16.4	8.7	25.0	188.3	47.09	15.4	7.7	24.0	282.5	67.80	16.4	6.7	23.0	376.7	86.64	15.4	6.7	23.0	470.9	108.30
57	A108	VERWOERDPARK	7	3	20.9	4.1	25.0	188.3	47.09	20.9	4.1	25.0	282.5	70.63	20.9	4.1	25.0	376.7	94.17	20.9	4.1	25.0	470.9	117.71
58	A109	ALBERTON North	6	2	25.5	37.5	63.0	241.9	152.38	25.5	32.5	58.0	356.5	206.78	25.5	27.5	53.0	465.4	246.65	25.5	22.5	48.0	566.7	271.99
59	A111	NEW REDRUTH	2	0	13.0	4.0	17.0	188.3	32.02	13.0	3.0	16.0	282.5	45.20	13.0	3.0	16.0	376.7	60.27	13.0	3.0	16.0	470.8	75.33

Note: PP = Present price
I = Indoors
O = Outdoors
T = Total
C = Cents
R = Rand

CV Survey Database for Upper Income Group (U)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP+50%)					Water Usage (PP+100%)					Water Usage (PP+150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A001	RANDHART	5	3	13.6	6.4	20.0	188.3	37.67	12.6	6.4	19.0	282.5	53.68	12.6	4.4	17.0	376.7	64.04	12.6	4.4	17.0	470.9	80.04
2	A010	BRACKENHURST	4	1	21.1	1.9	23.0	188.3	43.32	20.1	1.9	22.0	282.5	62.15	20.1	1.9	22.0	376.7	82.87	20.1	1.9	22.0	470.9	103.59
3	A011	BRACKENHURST	6	3	51.7	3.3	55.0	234.8	129.13	51.7	3.3	55.0	352.2	193.70	43.7	3.3	47.0	450.6	211.78	35.7	3.3	39.0	529.8	206.63
4	A013	BRACKENDOWNS	5	2	25.6	2.4	28.0	188.3	52.74	24.6	2.4	27.0	282.5	76.28	21.6	2.4	24.0	376.7	90.40	21.6	2.4	24.0	470.9	113.00
5	A014	BRACKENDOWNS	4	2	26.0	2.0	28.0	188.3	52.74	26.0	2.0	28.0	282.5	79.10	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
6	A015	BRACKENDOWNS	4	1	27.8	2.2	30.0	188.3	56.50	26.8	2.2	29.0	282.5	81.93	26.8	2.2	29.0	376.7	109.24	26.8	2.2	29.0	470.9	136.55
7	A016	BRACKENDOWNS	4	2	12.9	0.1	13.0	188.3	24.48	12.9	0.1	13.0	282.5	36.73	12.9	0.1	13.0	376.7	48.97	12.9	0.1	13.0	470.9	61.21
8	A017	BRACKENDOWNS	4	0	42.8	2.2	45.0	222.4	100.08	34.8	2.2	37.0	311.5	115.26	30.8	2.2	33.0	395.3	130.44	30.8	2.2	33.0	494.1	163.05
9	A018	BRACKENHURST	4	2	19.2	5.8	25.0	188.3	47.09	19.2	3.8	23.0	282.5	64.98	16.2	3.8	20.0	376.7	75.34	16.2	3.8	20.0	470.9	94.17
10	A019	BRACKENDOWNS	5	2	37.0	1.0	38.0	209.9	79.74	35.0	1.0	36.0	308.1	110.90	34.0	1.0	35.0	405.9	142.06	34.0	1.0	35.0	507.4	177.57
11	A020	RANDHART	6	3	41.7	17.3	59.0	238.6	140.76	41.7	15.3	57.0	355.1	202.42	41.7	13.3	55.0	469.6	258.27	40.7	13.3	54.0	584.4	315.57
12	A021	BRACKENHURST	4	1	21.6	5.4	27.0	188.3	50.85	20.6	5.4	26.0	282.5	73.45	20.6	5.4	26.0	376.7	97.94	20.6	5.4	26.0	470.9	122.42
13	A022	BRACKENDOWNS	6	0	39.7	0.3	40.0	213.9	85.56	39.7	0.3	40.0	320.8	128.33	36.7	0.3	37.0	415.4	153.68	33.7	0.3	34.0	500.9	170.31
14	A023	BRACKENDOWNS	6	0	52.9	7.1	60.0	239.4	143.66	52.9	5.1	58.0	356.5	206.78	50.9	5.1	56.0	471.6	264.08	50.9	5.1	56.0	589.5	330.10
15	A024	BRACKENDOWNS	4	2	29.4	0.6	30.0	188.3	56.50	25.4	0.6	26.0	282.5	73.45	20.4	0.6	21.0	376.7	79.10	20.4	0.6	21.0	470.9	98.88
16	A025	BRACKENHURST	5	3	20.7	0.3	21.0	188.3	39.55	20.7	0.3	21.0	282.5	59.33	20.7	0.3	21.0	376.7	79.10	20.7	0.3	21.0	470.9	98.88
17	A026	BRACKENHURST	4	0	20.2	4.9	25.0	188.3	47.09	20.2	3.9	24.0	282.5	67.80	19.2	3.9	23.0	376.7	86.64	19.2	3.9	23.0	470.9	108.30
18	A027	BRACKENHURST	4	1	24.5	9.5	34.0	200.4	68.12	24.5	7.5	32.0	292.1	93.47	21.5	7.5	29.0	376.7	109.24	21.5	6.5	28.0	470.9	131.84
19	A028	BRACKENHURST	2	0	16.1	5.9	22.0	188.3	41.43	14.1	5.9	20.0	282.5	56.50	14.1	4.9	19.0	376.7	71.57	12.1	4.9	17.0	470.9	80.04
20	A029	BRACKENHURST	6	1	45.5	10.5	56.0	235.8	132.04	45.5	8.5	54.0	350.6	189.35	43.5	8.5	52.0	463.2	240.84	41.5	8.5	50.0	573.0	286.52
21	A030	BRACKENHURST	2	0	13.6	0.4	14.0	188.3	26.37	13.6	0.4	14.0	282.5	39.55	11.6	0.4	12.0	376.7	45.20	11.6	0.4	12.0	470.9	56.50
22	A031	BRACKENHURST	5	2	24.1	5.9	30.0	188.3	56.50	24.1	4.9	29.0	282.5	81.93	24.1	3.9	28.0	376.7	105.47	24.1	3.9	28.0	470.9	131.84
23	A032	BRACKENHURST	5	3	29.6	5.4	35.0	202.9	71.03	29.6	4.4	34.0	300.5	102.18	27.6	4.4	32.0	389.5	124.62	26.6	4.4	31.0	479.1	148.52
24	A033	BRACKENHURST	3	0	18.8	38.2	57.0	236.8	134.95	18.8	33.2	52.0	347.4	180.63	18.8	28.2	47.0	450.6	211.78	18.8	23.2	42.0	543.8	228.41
25	A034	BRACKENHURST	4	0	29.1	2.9	32.0	194.7	62.31	24.1	2.9	27.0	282.5	76.28	24.1	1.9	26.0	376.7	97.94	22.1	1.9	24.0	470.9	113.00
26	A035	BRACKENHURST	4	0	23.1	6.9	30.0	188.3	56.50	22.1	6.9	29.0	282.5	81.93	22.1	5.9	28.0	376.7	105.47	22.1	5.9	28.0	470.9	131.84
27	A036	BRACKENHURST	4	2	30.5	1.5	32.0	194.7	62.31	28.5	1.5	30.0	282.5	84.75	26.5	1.5	28.0	376.7	105.47	26.5	1.5	28.0	470.9	131.84
28	A037	BRACKENHURST	4	0	31.5	23.5	55.0	234.8	129.13	31.5	7.5	39.0	317.9	123.97	30.5	7.5	38.0	419.7	159.49	30.5	7.5	38.0	524.6	199.36
29	A038	BRACKENHURST	5	0	25.1	11.9	37.0	207.7	76.84	25.1	9.9	35.0	304.4	106.54	25.1	7.9	33.0	395.3	130.44	25.1	7.9	33.0	494.1	163.05
30	A053	RANDHART	3	1	10.4	6.6	17.0	188.3	32.02	10.4	4.6	15.0	282.5	42.38	10.4	3.6	14.0	376.7	52.74	10.4	3.6	14.0	470.9	65.92
31	A054	RANDHART	3	0	13.8	5.2	19.0	188.3	35.78	13.8	4.2	18.0	282.5	50.85	12.8	3.2	16.0	376.7	60.27	12.8	3.2	16.0	470.9	75.34
32	A055	RANDHART	5	2	27.2	4.8	32.0	194.7	62.31	27.2	2.8	30.0	282.5	84.75	25.2	2.8	28.0	376.7	105.47	25.2	2.8	28.0	470.9	131.84
33	A056	RANDHART	5	3	16.7	8.4	25.0	188.3	47.09	16.7	7.4	24.0	282.5	67.80	16.7	6.4	23.0	376.7	86.64	16.7	6.4	23.0	470.9	108.30
34	A057	RANDHART	7	3	26.7	1.3	28.0	188.3	52.74	25.7	1.3	28.0	282.5	79.10	26.7	1.3	28.0	376.7	105.47	26.7	1.3	28.0	470.9	131.84
35	A058	RANDHART	6	1	32.5	1.5	34.0	200.4	68.12	31.5	1.5	33.0	296.5	97.83	29.5	1.5	31.0	383.3	118.81	29.5	1.5	31.0	479.1	148.52
36	A059	RANDHART	3	0	27.6	7.4	35.0	202.9	71.03	27.6	6.4	34.0	300.5	102.18	24.6	5.4	30.0	376.7	113.00	23.6	5.4	29.0	470.9	136.55
37	A060	RANDHART	6	1	64.4	15.6	80.0	252.2	201.77	64.4	13.6	78.0	376.8	293.94	60.4	13.6	74.0	498.2	368.67	57.4	13.6	71.0	618.4	439.05
38	A061	RANDHART	4	1	27.0	0.0	27.0	188.3	50.85	26.0	0.0	26.0	282.5	73.45	25.0	0.0	25.0	376.7	94.17	25.0	0.0	25.0	470.9	117.71
39	A062	RANDHART	5	2	28.4	3.6	32.0	194.7	62.31	28.4	2.6	31.0	287.5	89.11	27.4	2.6	30.0	376.7	113.00	27.4	2.6	30.0	470.9	141.26
40	A063	RANDHART	4	0	22.0	8.0	30.0	188.3	56.50	22.0	8.0	30.0	282.5	84.75	22.0	6.0	28.0	376.7	105.47	22.0	6.0	28.0	470.9	131.84
41	A064	RANDHART	7	2	36.1	14.9	51.0	230.4	117.51	36.1	11.9	48.0	340.0	163.20	36.1	8.9	45.0	444.8	200.16	33.1	8.9	42.0	543.8	228.41
42	A083	MEYERSDAL	5	2	15.1	9.9	25.0	188.3	47.09	15.1	9.9	25.0	282.5	70.63	15.1	9.9	25.0	376.7	94.17	15.1	9.9	25.0	470.9	117.71
43	A090	MEYERSDAL EXT 21	2	0	13.7	1.3	15.0	188.3	28.25	12.7	1.3	14.0	282.5	39.55	12.7	1.3	14.0	376.7	52.74	12.7	1.3	14.0	470.9	65.92
44	A091	BRACKENDOWNS	3	1	16.0	0.0	16.0	188.3	30.13	16.0	0.0	16.0	282.5	45.20	14.0	0.0	14.0	376.7	52.74	14.0	0.0	14.0	470.9	65.92
45	A092	BRACKENHURST	2	0	13.3	3.7	17.0	188.3	32.02	13.3	3.7	17.0	282.5	48.03	12.3	3.7	16.0	376.7	60.27	12.3	2.7	15.0	470.9	70.63
46	A093	ALBERANTE	3	0	20.0	0.0	20.0	188.3	37.67	20.0	0.0	20.0	282.5	56.50	18.0	0.0	18.0	376.7	67.80	17.0	0.0	17.0	470.9	80.04
47	A097	BRACKENHURST	7	2	20.1	12.9	33.0	197.6	65.22	20.1	10.9	31.0	287.5	89.11	20.1	8.9	29.0	376.7	109.24	20.1	7.9	28.0	470.9	131.84
48	A098	BRACKENHURST	3	0	16.5	3.5	20.0	188.3	37.67	16.5	2.5	19.0	282.5	53.68	15.5	2.5	18.0	376.7	67.80	15.5	2.5	18.0	470.9	84.75
49	A099	BRACKENHURST	2	0	18.7	11.3	30.0	188.3	56.50	14.7	11.3	26.0	282.5	73.45	14.7	10.3	25.0	376.7	94.17	14.7	10.3	25.0	470.9	117.71
50	A107	RANDHART	6	1	36.2	4.8	41.0	215.8	88.46	36.2	2.8	39.0	317.9	123.97	35.2	2.8	38.0	419.7	159.49	35.2	2.8	38.0	524.6	199.36
51	A112	BRACKENDOWNS	2	0	12.5	7.5	20.0	188.3	37.67	12.5	4.5	17.0	282.5	48.03	12.5	4.5	17.0	376.7	64.04	12.5	4.5	17.0	470.8	80.04
52	A113	BRAKENHURST	3	0	17.1	2.9	20.0	188.3	37.67	17.1	2.9	20.0	282.5	56.50	17.1	2.9	20.0	376.7	75.34	17.1	2.9	20.0	470.8	94.17

Note: PP = Present price T = Total
I = Indoors C = Cents
O = Outdoors R = Rand

Table H.3

CV Survey Database for Lower Income Group (L)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP + 50%)					Water Usage (PP + 100%)					Water Usage (PP + 150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A100	EDEN PARK	6	2	29.7	0.3	30.0	188.3	56.50	28.7	0.3	29.0	282.5	81.93	28.7	0.3	29.0	376.7	109.24	28.7	0.3	29.0	470.9	136.55
2	A110	EDEN PARK	7	2	37.9	0.1	38.0	209.9	79.74	36.9	0.1	37.0	311.5	115.26	34.9	0.1	35.0	405.9	142.06	34.9	0.1	35.0	507.4	177.57
3	T01	Thokoza	2	0	7.6	1.4	9.0	188.3	16.95	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	4.6	1.4	6.0	470.9	28.25
4	T02	Thokoza	3	1	13.3	0.7	14.0	188.3	26.37	13.3	0.7	14.0	282.5	39.55	12.3	0.7	13.0	376.7	48.97	11.3	0.7	12.0	470.9	56.50
5	T03	Thokoza	8	3	31.8	4.2	36.0	205.4	73.93	31.8	4.2	36.0	308.9	111.19	29.8	4.2	34.0	400.7	136.24	28.9	4.2	33.0	494.1	163.05
6	T04	Thokoza	14	6	26.1	0.9	27.0	188.3	50.85	26.1	0.9	27.0	282.5	76.28	25.1	0.9	26.0	376.7	97.94	24.1	0.9	25.0	470.9	117.71
7	T05	Thokoza	9	4	26.9	3.1	30.0	188.3	56.50	23.9	3.1	27.0	282.5	76.28	21.9	3.1	25.0	376.7	94.17	20.9	3.1	24.0	470.9	113.00
8	T06	Thokoza	7	3	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
9	T07	Thokoza	5	3	14.0	2.0	16.0	188.3	30.13	14.0	2.0	16.0	282.5	45.20	13.0	2.0	15.0	376.7	56.50	12.0	2.0	14.0	470.9	65.92
10	T08	Thokoza	7	4	21.6	1.4	23.0	188.3	43.32	21.6	1.4	23.0	282.5	64.98	21.6	1.4	23.0	376.7	86.64	19.6	1.4	21.0	470.9	98.86
11	T09	Thokoza	8	2	34.5	2.5	37.0	188.3	76.84	34.5	2.5	37.0	311.5	115.26	32.5	2.5	35.0	405.9	142.06	31.5	2.5	34.0	500.9	170.31
12	T10	Thokoza	8	3	35.9	3.1	39.0	188.3	82.65	35.9	3.1	39.0	317.9	123.97	34.9	3.1	38.0	419.7	159.49	33.9	3.1	37.0	519.2	192.10
13	T11	Thokoza	11	1	9.2	4.8	14.0	188.3	26.37	9.2	4.8	14.0	282.5	39.55	8.2	4.8	13.0	376.7	48.97	8.2	3.8	12.0	470.9	56.50
14	T12	Thokoza	5	2	29.0	0.0	29.0	188.3	54.74	28.0	0.0	28.0	282.5	79.10	29.0	0.0	29.0	376.7	109.47	25.0	0.0	25.0	470.9	117.71
15	T13	Thokoza	4	2	7.6	1.4	9.0	188.3	16.95	7.6	1.4	9.0	282.5	25.43	6.6	1.4	8.0	376.7	30.13	5.6	1.4	7.0	470.9	32.96
16	T14	Thokoza	6	2	18.6	0.4	19.0	188.3	35.78	16.6	0.4	17.0	282.5	48.03	15.6	0.4	17.0	376.7	64.04	14.6	0.4	15.0	470.9	70.63
17	T15	Thokoza	7	3	8.4	1.6	10.0	188.3	18.83	8.4	1.6	10.0	282.5	28.25	7.4	1.6	9.0	376.7	33.90	7.4	0.6	8.0	470.9	37.67
18	T16	Thokoza	6	4	15.3	3.7	19.0	188.3	35.78	15.3	3.7	19.0	282.5	53.68	14.3	3.7	18.0	376.7	67.80	13.3	2.7	16.0	470.9	75.34
19	T17	Thokoza	6	1	9.6	7.4	17.0	188.3	32.02	9.6	7.4	17.0	282.5	48.03	9.6	6.4	16.0	376.7	60.27	8.6	6.4	15.0	470.9	70.63
20	T18	Thokoza	4	2	14.7	7.3	22.0	188.3	41.43	14.7	7.3	22.0	282.5	62.15	12.7	7.3	20.0	376.7	75.34	12.7	5.3	18.0	470.9	84.75
21	T19	Thokoza	10	4	14.8	0.2	15.0	188.3	28.25	14.8	0.2	15.0	282.5	42.38	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.21
22	T20	Thokoza	3	0	32.5	16.5	49.0	226.0	111.70	27.5	16.5	44.0	331.3	145.75	27.5	13.5	41.0	431.5	176.92	27.5	13.5	41.0	539.4	221.15
23	T21	Thokoza	11	5	26.1	18.9	45.0	222.4	100.08	24.1	18.9	43.0	328.9	141.41	24.1	16.9	41.0	431.5	176.92	23.1	16.9	40.0	534.7	213.89
24	T22	Thokoza	9	5	21.0	2.0	23.0	188.3	43.32	20.0	2.0	22.0	282.5	62.15	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
25	T23	Thokoza	5	2	23.8	2.2	26.0	188.3	48.97	21.8	2.2	24.0	282.5	67.80	20.8	2.2	23.0	376.7	86.64	20.8	2.2	23.0	470.9	108.20
26	T24	Thokoza	3	3	21.2	3.8	25.0	188.3	47.09	20.2	3.8	24.0	282.5	67.80	20.2	3.8	24.0	376.7	90.40	20.2	3.8	24.0	470.9	113.00
27	T25	Thokoza	2	1	6.6	6.4	13.0	188.3	24.48	5.6	5.4	11.0	282.5	31.08	5.6	5.4	11.0	376.7	41.43	5.6	5.4	11.0	470.9	51.79
28	T26	Thokoza	7	4	20.8	1.2	22.0	188.3	41.43	20.8	1.2	22.0	282.5	62.15	19.8	1.2	21.0	376.7	79.10	18.8	1.2	20.0	470.9	94.17
29	T27	Thokoza	4	2	11.8	6.2	18.0	188.3	33.90	11.8	6.2	18.0	282.5	50.85	11.8	6.2	18.0	376.7	67.80	10.8	4.2	15.0	470.9	70.63
30	T28	Thokoza	6	3	19.7	0.3	20.0	188.3	37.67	19.7	0.3	20.0	282.5	56.50	17.7	0.3	18.0	376.7	67.80	17.7	0.3	18.0	470.9	84.75
31	T29	Thokoza	6	2	22.2	2.8	25.0	188.3	47.09	22.2	2.8	25.0	282.5	70.63	22.2	2.8	25.0	376.7	94.17	22.2	2.8	25.0	470.9	117.71
32	T30	Thokoza	7	4	25.5	1.5	27.0	188.3	50.85	23.5	1.5	25.0	282.5	70.63	22.5	1.5	24.0	376.7	90.40	22.5	1.5	24.0	470.9	113.00
33	T31	Thokoza	4	3	19.1	6.0	25.0	188.3	47.09	19.1	6.0	25.0	282.5	70.63	19.1	6.0	25.0	376.7	94.17	17.1	6.0	23.0	470.9	108.30
34	T32	Thokoza	5	2	21.2	0.8	22.0	188.3	41.43	21.2	0.8	22.0	282.5	62.15	20.2	0.8	21.0	376.7	79.10	20.2	0.8	21.0	470.9	98.88
35	T33	Thokoza	6	4	8.9	3.1	12.0	188.3	22.60	8.9	3.1	12.0	282.5	33.90	7.9	3.1	11.0	376.7	41.43	6.9	3.1	10.0	470.9	47.09
36	T34	Thokoza	14	0	19.0	13.0	32.0	194.7	62.31	18.0	13.0	31.0	287.5	89.11	18.0	12.0	30.0	376.7	113.00	18.0	11.0	29.0	470.9	136.55
37	T35	Thokoza	4	2	6.3	1.7	8.0	188.3	15.07	6.3	1.7	8.0	282.5	22.60	6.3	1.7	8.0	376.7	30.13	6.3	0.7	7.0	470.9	32.96
38	T36	Thokoza	6	3	13.7	0.3	14.0	188.3	26.37	12.7	0.3	13.0	282.5	36.73	12.7	0.3	13.0	376.7	48.97	11.7	0.3	12.0	470.9	56.50
39	T37	Thokoza	10	6	10.7	7.3	18.0	188.3	33.90	8.7	7.3	16.0	282.5	45.20	8.7	6.3	15.0	376.7	56.50	8.7	5.3	14.0	470.9	65.92
40	T38	Thokoza	8	5	28.5	10.5	39.0	211.9	82.65	26.5	10.5	37.0	311.5	115.26	26.5	9.5	36.0	410.7	147.87	25.5	8.5	34.0	500.9	170.31
41	T40	Thokoza	12	7	7.0	0.0	7.0	188.3	13.18	7.0	0.0	7.0	282.5	19.78	7.0	0.0	7.0	376.7	26.37	7.0	0.0	7.0	470.9	32.96
42	T41	Thokoza	5	3	21.9	0.1	22.0	188.3	41.43	21.9	0.1	22.0	282.5	62.15	20.9	0.1	21.0	376.7	79.10	19.9	0.1	20.0	470.9	94.17
43	T42	Thokoza	3	0	2.9	0.1	3.0	188.3	5.65	2.9	0.1	3.0	282.5	8.48	2.9	0.1	3.0	376.7	11.30	2.9	0.1	3.0	470.9	14.13
44	T43	Thokoza	4	2	3.0	0.0	3.0	188.3	5.65	3.0	0.0	3.0	282.5	8.48	3.0	0.0	3.0	376.7	11.30	3.0	0.0	3.0	470.9	14.13
45	T44	Thokoza	8	4	14.1	3.9	18.0	188.3	33.90	13.1	3.9	17.0	282.5	48.03	12.1	3.9	16.0	376.7	60.27	12.1	2.9	15.0	470.9	70.63
46	T45	Thokoza	7	3	4.0	0.0	4.0	188.3	7.53	4.0	0.0	4.0	282.5	11.30	4.0	0.0	4.0	376.7	15.07	4.0	0.0	4.0	470.9	18.83
47	T46	Thokoza	6	2	7.3	3.7	11.0	188.3	20.72	6.3	3.7	10.0	282.5	28.25	5.3	3.7	9.0	376.7	33.90	4.3	3.7	8.0	470.9	37.67
48	T47	Thokoza	7	3	6.2	1.8	8.0	188.3	15.07	6.2	1.8	8.0	282.5	22.60	4.2	1.8	6.0	376.7	22.60	4.2	0.8	5.0	470.9	23.54
49	T48	Thokoza	6	3	6.6	1.4	8.0	188.3	15.07	6.6	1.4	8.0	282.5	22.60	5.6	1.4	7.0	376.7	26.37	4.6	1.4	6.0	470.9	28.25
50	T49	Thokoza	2	0	27.3	8.7	36.0	205.4	73.93	26.3	8.7	35.0	304.4	106.54	26.3	8.7	35.0	405.9	142.06	25.3	8.7	34.0	500.9	170.31

Note: PP = Present price
I = Indoors
O = Outdoors
T = Total
C = Cents
R = Rand

Table H.1

CV Survey Database for Middle Income Group (M)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP + 50%)					Water Usage (PP + 100%)					Water Usage (PP + 150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A002	MAYBERRY PARK	5	2	40.3	0.7	41.0	215.8	88.46	38.3	0.7	39.0	317.9	123.97	37.3	0.7	38.0	470.7	178.93	37.3	0.7	38.0	524.8	199.36
2	A003	ALBERTON NORTH	5	0	31.7	4.3	36.0	205.4	73.93	30.7	3.3	34.0	300.5	102.19	29.7	2.3	32.0	389.5	124.62	29.7	2.3	31.3	479.1	149.52
3	A004	FLORENTIA	3	0	12.9	1.1	15.0	188.3	28.25	13.9	1.1	15.0	282.5	42.38	11.9	1.1	13.0	376.7	48.97	9.9	1.1	11.2	470.9	51.79
4	A005	ALBERTON NOORD	1	1	21.7	0.3	22.0	188.3	41.43	21.7	0.3	22.0	282.5	62.15	19.7	0.3	20.0	376.7	75.34	17.7	0.3	18.0	470.9	84.76
5	A006	ALBERTON NORTH	6	2	31.9	3.4	35.5	202.9	71.03	31.6	3.4	35.0	304.4	106.54	30.6	1.4	32.0	389.5	124.62	28.6	1.4	30.0	470.9	141.26
6	A007	ALBERTON NORTH	3	1	16.5	6.5	23.0	188.3	43.32	16.5	6.5	23.0	282.5	64.98	15.5	6.5	22.0	376.7	75.34	15.5	6.5	22.0	470.9	94.17
7	A008	ALBERTSDAL	1	0	7.2	0.8	8.0	188.3	15.07	7.2	0.8	8.0	282.5	22.60	6.2	0.8	7.0	376.7	26.37	6.2	0.8	7.0	470.9	32.96
8	A009	ALBERTSDAL	2	0	20.5	1.4	22.0	188.3	41.43	19.6	0.4	20.0	282.5	56.50	18.6	0.4	19.0	376.7	71.57	17.6	0.4	18.0	470.9	84.76
9	A012	ALBERTSDAL	4	0	23.6	1.6	25.0	188.3	47.09	23.5	1.6	25.0	282.5	70.63	22.5	1.6	24.0	376.7	90.40	22.5	1.6	24.0	470.9	113.00
10	A039	FLORENTIA	3	0	12.7	2.3	15.0	188.3	28.25	11.7	2.3	14.0	282.5	39.55	10.7	2.3	13.0	376.7	48.97	10.7	2.3	13.0	470.9	61.21
11	A040	FLORENTIA	7	0	14.8	5.2	20.0	188.3	37.67	13.8	4.2	18.0	282.5	50.85	12.8	4.2	17.0	376.7	64.04	12.8	4.2	17.0	470.9	80.04
12	A041	FLORENTIA	3	0	10.5	2.5	13.0	188.3	24.48	9.5	1.5	11.0	282.5	31.08	8.5	1.5	10.0	376.7	37.67	8.5	1.5	10.0	470.9	47.09
13	A042	FLORENTIA	2	0	10.6	2.4	13.0	188.3	24.48	9.6	1.4	11.0	282.5	31.08	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
14	A043	FLORENTIA	4	1	15.4	1.6	17.0	188.3	32.00	15.4	0.6	16.0	282.5	45.20	14.4	0.6	15.0	376.7	56.50	13.4	0.6	14.0	470.9	65.92
15	A044	FLORENTIA	2	0	11.6	1.4	13.0	188.3	24.48	10.6	1.4	12.0	282.5	33.90	9.6	1.4	11.0	376.7	41.43	9.6	1.4	11.0	470.9	51.79
16	A045	CEN ALBERTSPARK	4	0	13.4	2.6	16.0	188.3	30.13	13.4	1.6	15.0	282.5	42.38	11.4	1.6	13.0	376.7	48.97	11.4	1.6	13.0	470.9	61.21
17	A046	GENL ALBERTSPARK	5	0	25.9	1.1	27.0	188.3	50.74	25.9	1.1	27.0	282.5	76.28	24.9	1.1	26.0	376.7	97.94	22.9	1.1	24.0	470.9	113.00
18	A047	MAYBERRY PARK	7	5	58.3	3.7	64.0	242.6	155.28	56.3	3.7	62.0	361.6	224.20	52.3	3.7	56.0	475.4	266.22	44.3	3.7	50.0	573.0	286.52
19	A048	MAYBERRY PARK	3	2	14.8	6.2	21.0	188.3	39.55	14.8	6.2	21.0	282.5	59.33	14.8	5.2	20.0	376.7	75.34	14.8	5.2	20.0	470.9	94.17
20	A049	MAYBERRY PARK	4	1	22.9	4.1	27.0	188.3	50.85	22.9	3.1	26.0	282.5	73.45	21.9	3.1	25.0	376.7	94.17	21.9	3.1	25.0	470.9	117.71
21	A050	MAYBERRY PARK	6	4	30.9	0.1	31.0	191.6	59.41	25.9	0.1	27.0	282.5	76.28	25.9	0.1	26.0	376.7	97.94	25.9	0.1	26.0	470.9	122.42
22	A051	RACEVIEW	3	0	9.4	0.6	10.0	188.3	18.83	9.4	0.6	10.0	282.5	28.25	9.4	0.6	10.0	376.7	37.67	9.4	0.6	10.0	470.9	47.09
23	A052	RACEVIEW	2	0	12.6	5.4	18.0	188.3	33.90	12.6	3.4	16.0	282.5	45.20	12.6	3.4	16.0	376.7	60.27	12.6	3.4	16.0	470.9	75.34
24	A065	SOUTH CREST	2	0	8.6	1.4	10.0	188.3	18.83	8.6	1.4	10.0	282.5	28.25	8.6	1.4	10.0	376.7	37.67	8.6	1.4	10.0	470.9	47.09
25	A066	SOUTH CREST	2	0	9.2	1.8	11.0	188.3	20.72	9.2	0.8	10.0	282.5	28.25	9.2	0.8	10.0	376.7	37.67	9.2	0.8	10.0	470.9	47.09
26	A067	SOUTHCREST	2	0	7.5	3.5	17.0	188.3	32.02	7.5	7.5	15.0	282.5	42.38	7.5	6.5	14.0	376.7	52.74	7.5	6.5	14.0	470.9	65.92
27	A068	VERWOERDPARK	4	0	33.7	1.3	35.0	202.9	71.03	33.7	1.3	35.0	304.4	106.54	32.7	1.3	34.0	400.7	136.24	30.7	1.3	32.0	486.8	155.78
28	A069	VERWOERDPARK	2	0	6.0	7.0	13.0	188.3	24.48	6.0	6.0	12.0	282.5	33.90	6.0	6.0	12.0	376.7	45.20	6.0	6.0	12.0	470.9	56.50
29	A070	VERWOERDPARK	2	0	12.9	2.1	15.0	188.3	28.25	11.9	2.1	14.0	282.5	39.55	11.9	2.1	14.0	376.7	52.74	11.9	2.1	14.0	470.9	65.92
30	A071	VERWOERDPARK	2	0	9.0	2.0	11.0	188.3	20.72	9.0	2.0	11.0	282.5	31.08	9.0	2.0	11.0	376.7	41.43	9.0	2.0	11.0	470.9	51.79
31	A072	VERWOERDPARK	4	1	24.8	3.2	28.0	188.3	52.74	24.8	3.2	28.0	282.5	79.10	24.8	2.2	27.0	376.7	101.70	21.8	2.2	24.0	470.9	113.00
32	A073	VERWOERDPARK	3	0	22.7	2.3	25.0	188.3	47.09	21.7	2.3	24.0	282.5	67.80	21.7	2.3	24.0	376.7	90.40	21.7	2.3	24.0	470.9	113.00
33	A074	VERWOERDPARK	4	1	25.1	0.9	26.0	188.3	48.97	25.1	0.9	26.0	282.5	73.45	25.1	0.9	26.0	376.7	97.94	25.1	0.9	26.0	470.9	122.42
34	A075	VERWOERDPARK	3	0	10.5	24.5	35.0	202.9	71.03	10.5	21.5	32.0	292.1	93.47	10.5	18.5	29.0	376.7	109.24	10.5	14.5	25.0	470.9	117.73
35	A076	VERWOERDPARK	3	0	16.7	0.3	17.0	188.3	32.02	16.7	0.3	17.0	282.5	48.03	16.7	0.3	17.0	376.7	64.04	16.7	0.3	17.0	470.9	80.04
36	A077	VERWOERDPARK	4	1	34.7	21.3	56.0	235.6	132.04	34.7	21.3	56.0	353.7	198.06	34.7	13.3	48.0	453.3	217.59	30.7	13.3	44.0	552.1	242.94
37	A078	VERWOERDPARK	3	1	13.2	3.8	17.0	188.3	32.02	12.2	3.8	16.0	282.5	45.20	11.2	3.8	15.0	376.7	56.50	11.2	3.8	15.0	470.9	70.63
38	A079	VERWOERDPARK	2	0	9.5	3.5	13.0	188.3	24.48	9.5	2.5	12.0	282.5	33.90	8.5	2.5	11.0	376.7	41.43	8.5	2.5	11.0	470.9	51.79
39	A080	VERWOERDPARK	5	0	31.3	3.7	35.0	202.9	71.03	31.3	2.7	34.0	300.5	102.18	30.3	2.7	33.0	395.3	130.44	30.3	2.7	33.0	494.1	163.05
40	A081	VERWOERDPARK	3	1	19.1	1.9	20.0	188.3	37.67	18.1	1.9	20.0	282.5	56.50	18.1	1.9	20.0	376.7	75.34	18.1	1.9	20.0	470.9	94.17
41	A087	VERWOERDPARK	4	1	18.7	1.3	21.0	188.3	39.55	18.7	1.3	20.0	282.5	56.50	18.7	1.3	20.0	376.7	75.34	18.7	1.3	20.0	470.9	94.17
42	A084	VERWOERDPARK	4	0	33.6	6.4	40.0	213.9	85.56	28.6	5.4	34.0	300.5	102.18	25.6	4.4	30.0	376.7	113.00	22.6	4.4	27.0	470.9	127.13
43	A085	FLORENTIA	4	0	22.5	2.5	25.0	188.3	47.09	21.5	2.5	24.0	282.5	67.80	20.5	2.5	23.0	376.7	86.64	17.5	2.5	20.0	470.9	94.17
44	A086	VERWOERDPARK	4	1	20.9	0.1	21.0	188.3	39.55	18.9	0.1	20.0	282.5	56.50	18.9	0.1	19.0	376.7	71.57	18.9	0.1	19.0	470.9	89.46
45	A087	NEW REDRUTH	7	2	28.3	4.7	33.0	192.8	63.62	28.3	2.7	31.0	287.6	89.11	27.3	2.7	30.0	376.7	113.00	27.3	2.7	30.0	470.9	141.26
46	A088	FLORENTIA	4	1	23.5	8.5	32.0	194.7	62.31	23.5	8.5	32.0	282.5	84.75	23.5	4.5	28.0	376.7	105.47	22.5	4.5	27.0	470.9	127.13
47	A089		2	0	16.4	4.6	21.0	188.3	39.55	16.4	2.6	19.0	282.5	53.68	15.4	2.6	18.0	376.7	67.80	15.4	2.6	18.0	470.9	84.75
48	A094	ALBERTON	1	1	6.0	0.0	6.0	188.3	11.30	6.0	0.0	6.0	282.5	16.95	6.0	0.0	6.0	376.7	22.60	6.0	0.0	6.0	470.9	28.25
49	A095	GENL ALBERTSPARK	5	2	17.8	0.2	18.0	188.3	33.90	17.8	0.2	18.0	282.5	50.85	17.8	0.2	18.0	376.7	67.80	17.8	0.2	18.0	470.9	84.75
50	A096	VERWOERDPARK	4	1	17.3	0.7	18.0	188.3	33.90	16.3	0.7	17.0	282.5	48.03	15.3	0.7	16.0	376.7	64.04	15.3	0.7	16.0	470.9	80.04
51	A101	FLORENTIA	5	0	19.5	3.5	23.0	188.3	43.32	19.5	2.5	22.0	282.5	62.15	18.5	2.5	21.0	376.7	79.10	18.5	2.5	21.0	470.9	98.88
52	A102	GENL ALBERTSPARK	2	0	10.7	0.3	11.0	188.3	20.72	9.7	0.3	10.0	282.5	28.25	9.7	0.3	10.0	376.7	37.67	9.7	0.3	10.0	470.9	47.09
53	A103	GENL ALBERTSPARK	4	1	30.0	0.0	30.0	188.3	56.50	29.0	0.0	29.0	282.5	81.93	27.0	0.0	27.0	376.7	101.70	27.0	0.0	27.0	470.9	127.13
54	A104	GENL ALBERTSPARK	2	0	13.8	0.2	14.0	188.3	26.37	12.8	0.2	13.0	282.5	36.73	12.8	0.2	13.0	376.7	48.97	12.8	0.2	13.0	470.9	61.21
55	A105	GENL ALBERTS PARK	5	2	16.8	0.2	17.0	188.3	32.02	16.8	0.2	17.0	282.5	48.03	16.8	0.2	17.0	376.7	64.04	16.8	0.2	17.0	470.9	80.04
56	A106	RACEVIEW	4	2	16.4	8.7	25.0	188.3	47.09	16.4	7.7	24.0	282.5	67.80	16.4	6.7	23.0	376.7	86.64	16.4	6.7	23.0	470.9	108.30
57	A108	VERWOERDPARK	7	3	20.9	4.1	25.0	188.3	47.09	20.9	4.1	25.0	282.5	70.63	20.9	4.1	25.0	376.7	94.17	20.9	4.1	25.0	470.9	117.71
58	A109	ALBERTON North	8	2	25.5	37.5	63.0	241.9	152.38	25.5	32.5	58.0	356.5	206.78	25.5	27.5	53.0	461.4	244.65	25.5	22.5	48.0	566.7	271.99
59	A111	NEW REDRUTH	2	0	13.0	4.0	17.0	188.3	32.02	13.0	3.0	16.0	282.5	45.20	13.0	3.0	16.0	376.7	60.27	13.0	3.0	16.0	470.8	75.33

Note: PP = Present price T = Total
I = Indoors C = Cents
O = Outdoors R = Rand

Table H.2

CV Survey Database for Upper Income Group (U)

No.	Respond. No.	Township	No of Persons		Water Usage (Present Price)					Water Usage (PP + 50%)					Water Usage (PP + 100%)					Water Usage (PP + 150%)				
			Total	No of Children	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)	Qty (I)	Qty (O)	Qty (T)	Price (C)	Bill (R)
1	A001	RANDHART	5	3	13.6	6.4	20.0	188.3	37.67	12.6	6.4	19.0	282.5	53.68	12.6	4.4	17.0	376.7	64.04	12.6	4.4	17.0	470.9	80.04
2	A010	BRACKENHURST	4	1	21.1	1.9	23.0	188.3	43.32	20.1	1.9	22.0	282.5	62.15	20.1	1.9	22.0	376.7	82.87	20.1	1.9	22.0	470.9	103.59
3	A011	BRACKENHURST	6	3	51.7	3.3	55.0	234.8	129.13	51.7	3.3	55.0	352.2	193.70	43.7	3.3	47.0	450.6	211.78	35.7	3.3	39.0	529.8	206.63
4	A013	BRACKENDOWNS	5	2	25.6	2.4	28.0	188.3	52.74	24.6	2.4	27.0	282.5	76.28	21.6	2.4	24.0	376.7	90.40	21.6	2.4	24.0	470.9	113.00
5	A014	BRACKENDOWNS	4	2	26.0	2.0	28.0	188.3	52.74	26.0	2.0	28.0	282.5	79.10	20.0	2.0	22.0	376.7	82.87	20.0	2.0	22.0	470.9	103.59
6	A015	BRACKENDOWNS	4	1	27.8	2.2	30.0	188.3	56.50	26.8	2.2	29.0	282.5	81.93	26.8	2.2	29.0	376.7	109.24	26.8	2.2	29.0	470.9	136.56
7	A016	BRACKENDOWNS	4	2	12.9	0.1	13.0	188.3	24.48	12.9	0.1	13.0	282.5	36.73	12.9	0.1	13.0	376.7	48.97	12.9	0.1	13.0	470.9	61.21
8	A017	BRACKENDOWNS	4	0	42.8	2.2	45.0	222.4	100.08	34.8	2.2	37.0	311.5	115.26	30.8	2.2	33.0	395.3	130.44	30.8	2.2	33.0	494.1	163.05
9	A018	BRACKENHURST	4	2	19.2	3.8	25.0	188.3	47.09	19.2	3.8	23.0	282.5	64.98	16.2	3.8	20.0	376.7	75.34	16.2	3.8	20.0	470.9	94.17
10	A019	BRACKENDOWNS	5	2	37.0	1.0	38.0	209.9	79.74	35.0	1.0	36.0	308.1	110.90	34.0	1.0	35.0	405.9	142.06	34.0	1.0	35.0	507.4	177.57
11	A020	RANDHART	6	3	41.7	17.3	59.0	238.5	140.76	41.7	15.3	57.0	355.1	202.42	41.7	13.3	55.0	469.6	258.27	40.7	13.3	54.0	584.4	315.57
12	A021	BRACKENHURST	4	1	21.6	5.4	27.0	188.3	50.85	20.6	5.4	26.0	282.5	73.45	20.6	5.4	26.0	376.7	97.94	20.6	5.4	26.0	470.9	122.42
13	A022	BRACKENDOWNS	6	0	39.7	0.3	40.0	212.9	85.56	39.7	0.3	40.0	320.8	128.33	36.7	0.3	37.0	415.4	153.68	33.7	0.3	34.0	500.9	170.31
14	A023	BRACKENDOWNS	6	0	52.9	7.1	60.0	239.4	143.66	52.9	5.1	58.0	356.5	206.78	50.9	5.1	56.0	471.6	264.08	50.9	5.1	56.0	589.5	330.10
15	A024	BRACKENDOWNS	4	2	29.4	0.6	30.0	188.3	56.50	25.4	0.6	26.0	282.5	73.45	20.4	0.6	21.0	376.7	79.10	20.4	0.6	21.0	470.9	98.88
16	A025	BRACKENHURST	5	3	20.7	0.3	21.0	188.3	39.55	20.7	0.3	21.0	282.5	59.33	20.7	0.3	21.0	376.7	79.10	20.7	0.3	21.0	470.9	98.88
17	A026	BRACKENHURST	4	0	20.2	4.9	25.0	188.3	47.09	20.2	3.9	24.0	282.5	67.80	19.2	3.9	23.0	376.7	86.64	19.2	3.9	23.0	470.9	108.30
18	A027	BRACKENHURST	4	1	24.5	9.5	34.0	200.4	88.12	24.5	7.5	32.0	292.1	93.47	21.5	7.5	29.0	376.7	109.24	21.5	6.5	28.0	470.9	131.84
19	A028	BRACKENHURST	2	0	16.1	5.9	22.0	188.3	41.43	14.1	5.9	20.0	282.5	56.50	14.1	4.9	19.0	376.7	71.57	12.1	4.9	17.0	470.9	80.04
20	A029	BRACKENHURST	6	1	45.5	10.5	56.0	235.8	132.04	45.5	8.5	54.0	350.9	189.35	43.5	8.5	52.0	463.2	240.84	41.5	8.5	50.0	573.0	286.52
21	A030	BRACKENHURST	2	0	13.6	0.4	14.0	188.3	26.37	13.6	0.4	14.0	282.5	39.55	11.6	0.4	12.0	376.7	45.20	11.6	0.4	12.0	470.9	56.50
22	A031	BRACKENHURST	5	2	24.1	5.9	30.0	188.3	56.50	24.1	4.9	29.0	282.5	81.93	24.1	3.9	28.0	376.7	105.47	24.1	3.9	28.0	470.9	131.84
23	A032	BRACKENHURST	5	3	29.6	5.4	35.0	202.9	71.03	29.6	4.4	34.0	300.5	102.18	27.6	4.4	32.0	389.5	124.62	26.6	4.4	31.0	479.1	148.52
24	A033	BRACKENHURST	3	0	18.8	38.2	57.0	236.8	134.95	18.8	33.2	52.0	347.4	180.63	18.8	28.2	47.0	450.6	211.78	18.8	23.2	42.0	543.8	228.41
25	A034	BRACKENHURST	4	0	29.1	2.9	32.0	194.7	62.31	24.1	2.9	27.0	282.5	76.28	24.1	1.9	26.0	376.7	97.94	22.1	1.9	24.0	470.9	113.00
26	A035	BRACKENHURST	4	0	23.1	6.9	30.0	188.3	56.50	22.1	6.9	29.0	282.5	81.93	22.1	5.9	28.0	376.7	105.47	22.1	5.9	28.0	470.9	131.84
27	A036	BRACKENHURST	4	2	30.5	1.5	32.0	194.7	62.31	28.5	1.5	30.0	282.5	84.75	26.5	1.5	28.0	376.7	105.47	26.5	1.5	28.0	470.9	131.84
28	A037	BRACKENHURST	4	0	31.5	23.5	55.0	234.8	129.13	31.5	7.5	39.0	317.9	123.97	30.5	7.5	38.0	419.7	159.49	30.5	7.5	38.0	524.6	199.36
29	A038	BRACKENHURST	5	0	25.1	11.9	37.0	207.7	76.84	25.1	9.9	35.0	304.4	106.54	25.1	7.9	33.0	395.3	130.44	25.1	7.9	33.0	494.1	163.05
30	A055	RANDHART	3	1	10.4	6.6	17.0	188.3	32.02	10.4	4.6	15.0	282.5	42.38	10.4	3.6	14.0	376.7	52.74	10.4	3.6	14.0	470.9	65.92
31	A054	RANDHART	3	0	13.8	5.2	19.0	188.3	35.78	13.8	4.2	18.0	282.5	50.85	12.8	3.2	16.0	376.7	60.27	12.8	3.2	16.0	470.9	75.34
32	A055	RANDHART	5	2	27.2	4.8	32.0	194.7	62.31	27.2	2.8	30.0	282.5	84.75	25.2	2.8	28.0	376.7	105.47	25.2	2.8	28.0	470.9	131.84
33	A056	RANDHART	5	3	16.7	8.4	25.0	188.3	47.09	16.7	7.4	24.0	282.5	67.80	16.7	6.4	23.0	376.7	86.64	16.7	6.4	23.0	470.9	108.30
34	A057	RANDHART	7	3	26.7	1.3	28.0	188.3	52.74	26.7	1.3	28.0	282.5	79.10	26.7	1.3	28.0	376.7	105.47	26.7	1.3	28.0	470.9	131.84
35	A058	RANDHART	6	1	32.5	1.5	34.0	200.4	68.12	31.5	1.5	33.0	296.5	97.83	29.5	1.5	31.0	383.3	118.81	29.5	1.5	31.0	479.1	148.52
36	A059	RANDHART	3	0	27.6	7.4	35.0	202.9	71.03	27.6	6.4	34.0	300.5	102.18	24.6	5.4	30.0	376.7	113.00	23.6	5.4	29.0	470.9	136.55
37	A060	RANDHART	6	1	64.4	15.6	80.0	252.2	201.77	64.4	13.6	78.0	376.8	293.94	60.4	13.6	74.0	498.2	368.67	57.4	13.6	71.0	618.4	439.05
38	A061	RANDHART	4	1	27.0	0.0	27.0	188.3	50.85	26.0	0.0	26.0	282.5	73.45	25.0	0.0	25.0	376.7	94.17	25.0	0.0	25.0	470.9	117.71
39	A062	RANDHART	5	2	28.4	3.6	32.0	194.7	62.31	28.4	2.6	31.0	287.5	89.11	27.4	2.6	30.0	376.7	113.00	27.4	2.6	30.0	470.9	141.26
40	A063	RANDHART	4	0	22.0	8.0	30.0	188.3	56.50	22.0	8.0	30.0	282.5	84.75	22.0	6.0	28.0	376.7	105.47	22.0	6.0	28.0	470.9	131.84
41	A064	RANDHART	7	2	36.1	14.9	51.0	230.4	117.51	36.1	11.9	48.0	340.0	163.20	36.1	8.9	45.0	444.8	200.16	33.1	8.9	42.0	543.8	228.41
42	A083	MEYERSDAL	5	2	15.1	9.9	25.0	188.3	47.09	15.1	9.9	25.0	282.5	70.63	15.1	9.9	25.0	376.7	94.17	15.1	9.9	25.0	470.9	117.71
43	A090	MEYERSDAL EXT 21	2	0	13.7	1.3	15.0	188.3	28.25	12.7	1.3	14.0	282.5	39.55	12.7	1.3	14.0	376.7	52.74	12.7	1.3	14.0	470.9	65.92
44	A091	BRACKENDOWNS	3	1	19.0	0.0	19.0	188.3	30.13	19.0	0.0	19.0	282.5	45.20	14.0	0.0	14.0	376.7	52.74	14.0	0.0	14.0	470.9	65.92
45	A092	BRACKENHURST	2	0	13.3	3.7	17.0	188.3	32.02	13.3	3.7	17.0	282.5	48.03	12.3	3.7	16.0	376.7	60.27	12.3	2.7	15.0	470.9	70.63
46	A093	ALBERANTE	3	0	20.0	0.0	20.0	188.3	37.67	20.0	0.0	20.0	282.5	56.50	18.0	0.0	18.0	376.7	67.80	17.0	0.0	17.0	470.9	80.04
47	A097	BRACKENHURST	7	2	20.1	12.9	33.0	197.6	65.22	20.1	10.9	31.0	287.5	89.11	20.1	8.9	29.0	376.7	109.24	20.1	7.9	28.0	470.9	131.84
48	A098	BRACKENHURST	3	0	16.5	3.5	20.0	188.3	37.67	16.5	2.5	19.0	282.5	53.68	16.5	2.5	18.0	376.7	67.80	15.5	2.5	18.0	470.9	84.75
49	A099	BRACKENHURST	2	0	18.7	11.3	30.0	188.3	56.50	14.7	11.3	26.0	282.5	73.45	14.7	10.3	25.0	376.7	94.17	14.7	10.3	25.0	470.9	117.71
50	A107	RANDHART	6	1	36.2	4.8	41.0	215.8	88.46	36.2	2.8	39.0	317.9	123.97	35.2	2.8	38.0	419.7	159.49	35.2	2.8	38.0	524.6	199.36
51	A112	BRACKENDOWNS	2	0	12.5	7.5	20.0	188.3	37.67	12.5	4.5	17.0	282.5	48.03	12.5	4.5	17.0	376.7	64.04	12.5	4.5	17.0	470.8	80.04
52	A113	BRAKENHURST	3	0	17.1	2.9	20.0	188.3	37.67	17.1	2.9	20.0	282.5	56.50	17.1	2.9	20.0	376.7	75.34	17.1	2.9	20.0	470.8	94.17

Note: PP = Present price; I = Indoors; O = Outdoors; T = Total; C = Cents; R = Rand

Table H.3

Average Basic Water Usage Rates for Indoors and Outdoors

1	**Bath**	**120 litres for average bath (1/2 full)**
2	Toilet cistern	9 litres (popular) or 11 litres (older type)
3	Shower	12 litres per minute – average shower is 6 to 7 minutes long, using approximately 70 litres of water.
4	Jacuzzi	200 litres
5	Sink	15 litres (average use for dishes)
6	Basin	10 litres (average filled)
7	Taps (Indoors and Outdoors)	½ inch: 9 litres per minute ¾ inch: 15 litres per minute
8	Washing machines (average for full load)	5 kg: 16 litres (varies between 9 and 23 litres for average load) 6 kg: 19 litres 8 kg: 26 litres 8.5 kg: 27 litres
9	Dish washing machines	25 litres for average cycle
10	Household water system	When designing new water supply system, Cobra-Tech size the system based on the use of 100 litres per day per person for a household of 6 persons.
11	Buckets	10 litres for average bucket. For Thokoza: 25 litres for washing clothes and bathing 10 litres for cooking and washing floors
12	Miscellaneous	Jug: 1 litre Pot: 2 litres

Table I.1

Note: The above figures (items 1-8) were obtained from Cobra Water Tech in Krugersdorp and are based on common average sized items.

APPENDIX J

Social-Scientific Appraisal of the Water Profile Survey

APPENDIX J

Social-Scientific Appraisal of the Water Profile Survey

1. Background

Following discussions on the report on the Water Usage Profile Survey at the Steering Committee Meeting of the 5th may 1998, EPE were requested to consult a beavioural scientist in order to investigate the possibilities of any behavioural bias during the survey. Consequently, Mr. Izak van Gass[1], a social scientist, was requested to evaluate the Water Profile Survey report in this respect. Mr. van Gass's was requested to focus on the following points:

- Comments on the sampling methodology and the value of the results;
- Comments on some of the behavioural dimensions, which have an impact on water usage;

The sections below include the comments from Mr. van Gass's evaluation, as well as supplementary comments from EPE where applicable.

2. Evaluation of the Water Usage Profile Survey

2.1. The Survey Sampling Methodology

2.1.1. Comments by Mr. van Gass:

Bearing in mind the present socio-political climate and factors such as crime and violence, house visits have become problematic, as there is often distrust and suspicion. The experience is that a researcher or interviewer who is known to the township community is preferred. Negative experience with past research surveys and "misleading" promises made to households are a reality. The general public may have reason to complain that they are bombarded by "research" which is of no benefit to them.

[1] Mr. Izak van Gass (MBA, MASoc Sc DIPLR)

The problems experienced in this specific study is understandable and often beyond the control of the interviewers.

The difficulties experienced in using a conventional sampling approach bearing in mind negative experiences with other surveys such as crime and fear etc., is therefore understandable. The use of the quota sampling system in these circumstances is justifiable.

The idea of sampling is to obtain a representative sample of the universum (population under study) in order to make general findings which is applicable to the population under study

From the available documentation it would seem as if the respondents had limited knowledge of the water supply cycle and the cost of water at the onset of the study. Some education and information was provided to the respondents, which influenced the research results. To use a quantitative approach in this specific study and then to generalise the results to the population may not be appropriate.

Bearing in mind the complexity of the problem, a strict quantitative critique of the sampling methodology is not appropriate. A qualitative assessment and approach based on consumers sharing their experience could yield the best results. It does not help to ask research questions on aspects of which customers have limited knowledge or understanding.

2.1.2. Comments by EPE:

The comments by Mr. van Gass essentially confirm the sampling methodology used in the study. It is also accepted by EPE that these results should not in general be used for national purposes.

2.2. Value of Results

2.2.1. Comments from Mr. van Gass:

Any price elasticity study of water must be evaluated holistically. One can assume that the research brief was given in the context of the fact that water in South Africa is becoming an increasingly scarce commodity, which will have to be funded with limited financial resources. It would seem as if the assumption has to be tested as to what the public's willingness and ability to pay for water really is, and what an equitable water pricing structure would be. Information has to be provided on which segments of society would be the most sensitive to price increases.

The average monthly water bill in Alberton of R 52.74 for the Upper Income Group quoted in the Survey report seems low. A price increase of say 20 % on R 52.74 may not therefor result in these families using less water. The mindset of the household members needs to be influenced by means of information and educational programmes.

Information on family expenditure patterns could be of value. A household in Alberton may have for example have to pay R 150.00 per month more on hire purchase and a housing bonds due to interest rate increases. To save say R 10.00 per month on a water bill may be perceived not to be worth the effort. Comfort can be more important than saving a few Rand when such savings are small.

2.2.2. Comments by EPE:

The average monthly water bill was derived from the respondents' perception of their usage of water. During the second survey, the CV Survey, the monthly bill derived from the first survey for each respondent, was reviewed and corrected where necessary. It was found that the majority of the respondents accepted the monthly bill derived from the water usage profile survey as being correct.

It is appreciated that a 20% increase in the price of water would probably have little effect on the water usage pattern. Hence for the second survey, the CV Survey, the price increase for water used in the experiment was +50%, +100% and +150%.

These high increases were postulated for the very reasons that Mr. van Gas cites, i.e., little water conservation would result from small increases in the price of water.

It is appreciated that the family expenditure pattern (as well as the income level) plays an important role in the users response to any increase in the price of water. From the historical data of the water usage patterns in Alberton, as mentioned in Chapter 6 (paragraph 6.5), the price of water did not appear to play an significant role on water consumers in the past as it was always readily available to them at a relatively insignificant cost. However, water is now becoming more of a scarce resource, and, by providing education on water usage patterns and how to reduce water usage, the habits of water consumers are likely to change.

2.3. Behavioural Influences on Water Consumption

2.3.1. Comments by Mr. Van Gass

Income and culture are cited as key variables impacting the use of water. Culture is a broad concept, which is subject to different interpretations. Other specific variables therefore need to be identified.

It is not only important to know how much water is used, the time when it is used is also important from a water demand perspective. Information on the use of water for gardening should for example include the time of use.

Other factors, which play a role in the use of water, should be considered. These are for example; type and size of housing, the nature of water supply e.g. outside tap borehole and the type of appliances used. The size of taps and type of toilets also has an important influence on the amount of water used.

In general some of he following factors could have an impact on the behaviour of consumers in respect of the use of water:

- Knowledge of the water supply cycle and the cost of water.

It would seem as if consumers have limited knowledge of the water supply cycle and the cost of bringing clean drinking water to them. Customers will not be willing to pay more for a product, which they may think, should be cheap. The picture and research results will change as their knowledge of the water supply process is improved.

- Understanding of the water and services account.
- Metering and account practices and the perceived accuracy of billing.

  It is obvious that price increases will have little or no impact on customers who are not individually metered. Communal metering e.g., one meter for various supply points, is viewed with distrust and is often a contributing factor to non- payment. The frequency and accuracy of metering is also often a problem. Customers do not necessarily separate the water and electricity component of their bills and may view water to be expensive when looking at the total bill.

- Satisfaction with the quality of municipal services - consumers do not always differentiate between elements of service provision.
- The type of appliances used, knowledge of the appliances and the water usage of appliances.
- Income and life styles.
- The type of water supply and the ease of access to the use of water.

The study does not show the importance role of some of the above-mentioned variables. Family size and income are important variables, which receive some attention. Other variables, which need to receive attention, are:

- Non-payment.

Consumers' willingness to pay and their perception of the value of water may be influenced by negative perceptions or experiences of other services e.g. sewerage waste removal roads etc.

Taking into consideration some of the historical constraints, a price elasticity study may not yield a true picture as to how consumers will respond to price increases, Consumers may for example, not be prepared to pay more for water if their level of satisfaction with other services is negative. In their minds services may be lumped together.

- Market segmentation.
- Habits and tradition.
- Type and size of housing.
- Access to electricity and the type of energy used.

2.3.2. Comments by EPE:

This research project is a pilot project and as such it was not possible to consider all the factors mentioned by Mr. van Gass for reasons of cost and time. Some of the major factors, which were considered, however, are the following:

- Income level.
- The price of water and the willingness to pay.
- Metering and non-payment; only individually metered consumers were considered.
- The various types of water consuming appliances.
- Access to boreholes.
- Education in the existing use of water and methods of saving water, e.g. installing reduced-flush cisterns, the use of shower restrictors, etc.

2.4. Recommendations

In addition the factors mentioned in section 2.3 above, Mr. van Gass recommended that the following factors be considered when undertaking similar studies in the future:

- Reference should be specified to previous research studies and focus on lessons learnt from other developing countries.
- There are similarities between electricity and water provision and joint research may be of value.
- Education and information programmes are of crucial importance. These programmes must be cost effective and research on the content and value of such programmes must be done.
- Future research should focus on pricing perceptions, e.g., is water expensive and should the price be increased, are people happy with the quality of water?

  In order to manage the demand for water, pricing alone will not be an effective management tool. Pricing combined with water conservation measures will be more appropriate. Basic needs must be met and people will not necessarily use less water if the price is increased. A toilet must still be flushed a certain number of times and basic activities such as cooking with water and washing dishes must still continue. The pricing of water must also be evaluated in the political and sociological context. If the price of water is perceived to be unfair it may lead to non-payment and other political pressures.
- It would be necessary to evaluate the benefits of water conservation and programmes and demand-side programme in addition to pricing.
- Future research should also provide information of household expenditure on products and services.

- Leaks and water losses also play an important role in the use of water. Focusing on a loss management would enhance the value of a price elasticity study.

3. Conclusions

The evaluation undertaken by the social scientist confirms the validity of the sampling methodology used and the approach taken by EPE in this project. Bearing in mind that this is a pilot project, all the important factors as recommended by Mr. van Gas have been taken into consideration; these are enumerated in paragraph 2.3.2 above.

APPENDIX K

Guidelines for Field Workers for

Data Acquisition using CV Methodology

CV SURVEY

Guideline for Fieldworkers for Data Acquisition Using CV Methodology

This manual uses four scenarios to demonstrate to field workers how to deal with different responses to questions posed to water consumers for purposes of data gathering for the CV experiment. The scenarios are:

- Scenario No. 1, 2 & 3: An example of a generally lower water consumer. The scenarios depict three different responses possible by respondent No. XYZ, based on the results of Survey No.1. The nature of the scenarios becomes clear in the explanation of the CV data gathering methodology given below.
- Scenario No.4: An example of a higher water consumer, and depicts a possible response by respondent ABC based on the results of Survey No. 1.

Although scenario No. 1 is used as the basis in explaining the method of how to acquire the data for Survey No. 2 in the explanation below, the same technique is used for all the four scenarios.

Method

1. Ensure that the respondent's details are correct and complete (page 5 below).
2. Questionnaire No 2 is then completed as follows (pages 6 and 7 below):

   Step 1: Briefly discuss the profile obtained from Survey No. 1 with the respondent (the profile for scenarios No. 1, 2 & 3 is on page 4 below). Come to an agreement with regard to the monthly bill. Details of the agreed monthly bill must be placed in the boxes provided under question 1 (page 7 below - Response to Questionnaire). Note in Scenarios 1 and 2, the respondent agrees with the Survey No 1 results. In Scenario 3, the respondent does not agree with the

Survey No 1 results; in this case enter in the boxes under question 1, (page 11 below - Response to Questionnaire), the figure agreed upon.

Step 2: The price of water is now raised by 50%. This new price of water per kilo-litres must be entered under question 2 of the questionnaire on page 6 below. This figure is obtained from Table 1, page 8 below (Water Bill for Different Average Price of Water) as follows:

Look along the row of the quantity of water used as has been agreed upon, in this scenario 8 kL, to the new average price of water increased by 50%, in this case 282.51. This figure together with the kL of water used (8 kL in this case) and the equivalent monthly water bill (in this case R22.60) is entered in the boxes provided, under question 2 on page 7 below (Response to the Questionnaire).

Step 3: Having shown the respondent the new resulting bill, ask him if he can afford this new bill or not. If he can afford the new bill, as is the case for this scenario 1, the same figures are entered in the boxes provided under question 3 of page 7 below. You then proceed to question 4 (page 6 below) of the Questionnaire.

If however, the respondent can not afford the new bill, he must be asked how he can save water so that his bill can be reduced, as is the case with scenario 4. (The method of how to do this is dealt with in greater detail in the next step).

Step 4: The price of water is now raised by 100 %. This new price must be entered under question 4 of the questionnaire (page 6 below). This new price is obtained by again looking along the row of the quantity of water used as has been agreed upon, in this scenario 8 kL, to the new average price of water increased by 100%, in this case 376.68. This figure together with the kL of water used (8 kL in this case) and the equivalent monthly water bill (in this case R30.13) is entered in the boxes provided, under question 4 on page 7 below (Response to the Questionnaire).

Now again the question is raised if he can afford the new price, or does he wish to reduce his water usage to obtain a lower bill. If he can afford the new water bill, you move on to question 6 on page 6 below.

If, as in this scenario 1, he decides to reduce his water bill, you need to discuss with him how he can accomplish this. In order for the respondent to make sensible adjustments to his water bill, his original water usage profile should be used to accomplish this. For example in this scenario 1, his greatest use of water is roughly 39% in the bathroom, i.e. 39% of 8 kL, i.e. about 3 kL per month. It would therefore seem reasonable that this respondent could reduce his water usage in the bathroom by 1 kL per month. He could also reduce water usage in his outdoor "Other" activities, where he uses 18% of 8 kL i.e. about 2 kL per month. In this scenario he decides to reduce the water usage in the bathroom by 1 kL and accepts the resulting new water bill of R 26.37 obtained from Table 1 (page 8 below). On agreement, the relevant figures are entered in the blocks under question 5 on page 7 below.

The process is continued in this way until the questionnaire is completed satisfactorily. Scenarios 2, 3 and 4 are variations, which also need to be studied and fully understood. The same basic principles for gathering data, however, apply to all of them.

EXAMPLE FOR SCENARIOS 1, 2 AND 3

Results of Survey No. 1

General Information:

Respondent No.:	XYZ
Township:	Alberton / Thokoza
Erf number:	1234
Account number:	-
Number of persons:	8

Household Profile:

Water usage over 1 week		
Indoor usage:	Litres	%
Bathroom	707	38.6%
Toilet	585	31.9%
Laundry	45	2.5%
Kitchen	165	9.0%
Other	0	0.0%
Sub-Total	1 502	82.0%
Outdoor usage:		
Garden	0	0.0%
Car	0	0.0%
Other	330	18.0%
Sub-Total	330	18.0%
Total	1 832	100%

Summary of Results:

Average water usage per day	262	litres/day
Average water usage per month	8	klitres/month
Equivalent monthly bill	R 15.07	

EXAMPLE FOR SCENARIOS 1, 2 and 3

WATER USAGE SURVEY No. 2

Water usage for selected households in Alberton and Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Name of respondent	*XYZ*
Township name	*Alberton or Thokoza*
Erf number	*1234*
Address	*Qwerty*
Telephone Number	*5678*
Date of interview	*12 April 1998*
Number of adults in household (including domestic servants)	*3*
Number of children in household (under 18)	*5*

Scenario No. 1:

No.	Question	Prompt
1	Discuss and agree on the estimate of the profile of water usage of the household, including the average summer monthly consumption figure and the resulting water bill.	Show the figures obtained in the first survey. Highlight the usage of water in the various categories summarised on the attached sheet. Discuss and record any changes.
2	Would your water consumption change if the price was increased to: *282.51* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 3. If NO record new water bill and proceed to question 4.
3	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
4	Would your water consumption change if the price was increased to: *376.68* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 5. If NO record new water bill and proceed to question 6.
5	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
6	Would your water consumption change if the price was increased to: *470.85* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 7. If NO record new water bill.
7	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
End of Questionnaire		

SCENARIO No. 1: RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	*188.34*	*8*	*15.07*	*Agrees with survey No. 1 results*
2	*282.51*	*8*	*22.60*	
3	*282.51*	*8*	*22.60*	*Accepts new bill, i.e. does not want to save any water*
4	*376.68*	*8*	*30.13*	
5	*376.68*	*7*	*26.37*	*Decided to reduce water usage in bathroom by 1 kL p.m.*
6	*470.85*	*8*	*37.67*	
7	*470.85*	*6*	*28.25*	*Decided to reduce water usage in bathroom by 1 kL + 1 kL in outdoor "Other' i.e. a total of 2 kL p.m.*

SCENARIO No. 1
Alberton Municipality
Table 1: Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs +100%		Present Water Costs +150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
1	188.34	1.88	282.51	2.83	376.68	3.77	470.85	4.71
2	188.34	3.77	282.51	5.65	376.68	7.53	470.85	9.42
3	188.34	5.65	282.51	8.48	376.68	11.30	470.85	14.13
4	188.34	7.53	282.51	11.30	376.68	15.07	470.85	18.83
5	188.34	9.42	282.51	14.13	376.68	18.83	470.85	23.54
6	188.34	11.30	282.51	16.95	376.68	22.60	470.85	28.25
7	188.34	13.18	282.51	19.78	376.68	26.37	470.85	32.96
8	188.34	15.07	282.51	22.60	376.68	30.13	470.85	37.67
9	188.34	16.95	282.51	25.43	376.68	33.90	470.85	42.38
10	188.34	18.83	282.51	28.25	376.68	37.67	470.85	47.09
11	188.34	20.72	282.51	31.08	376.68	41.43	470.85	51.79
12	188.34	22.60	282.51	33.90	376.68	45.20	470.85	56.50
13	188.34	24.48	282.51	36.73	376.68	48.97	470.85	61.21
14	188.34	26.37	282.51	39.55	376.68	52.74	470.85	65.92
15	188.34	28.25	282.51	42.38	376.68	56.50	470.85	70.63
16	188.34	30.13	282.51	45.20	376.68	60.27	470.85	75.34
17	188.34	32.02	282.51	48.03	376.68	64.04	470.85	80.04
18	188.34	33.90	282.51	50.85	376.68	67.80	470.85	84.75
19	188.34	35.78	282.51	53.68	376.68	71.57	470.85	89.46
20	188.34	37.67	282.51	56.50	376.68	75.34	470.85	94.17

SCENARIO No. 2 RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	*188.34*	*8*	*15.07*	*Agrees with the Survey no. 1 results*
2	*282.51*	*8*	*22.60*	
3	*282.51*	*8*	*22.60*	*Accepts new bill i.e. does not change water usage*
4	*376.68*	*8*	*33.90*	
5	*376.68*	*8*	*33.90*	*Accepts new bill i.e. does not change water usage*
6	*470.85*	*8*	*37.67*	
7	*470.85*	*7*	*32.96*	*Decides to reduce water usage in bathroom by 1 kL p.m.*

SCENARIO No. 2
Alberton Municipality
Table 1: Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs +100%		Present Water Costs +150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
1	188.34	1.88	282.51	2.83	376.68	3.77	470.85	4.71
2	188.34	3.77	282.51	5.65	376.68	7.53	470.85	9.42
3	188.34	5.65	282.51	8.48	376.68	11.30	470.85	14.13
4	188.34	7.53	282.51	11.30	376.68	15.07	470.85	18.83
5	188.34	9.42	282.51	14.13	376.68	18.83	470.85	23.54
6	188.34	11.30	282.51	16.95	376.68	22.60	470.85	28.25
7	188.34	13.18	282.51	19.78	376.68	26.37	470.85	32.96
8	188.34	15.07	282.51	22.60	376.68	30.13	470.85	37.67
9	188.34	16.95	282.51	25.43	376.68	33.90	470.85	42.38
10	188.34	18.83	282.51	28.25	376.68	37.67	470.85	47.09
11	188.34	20.72	282.51	31.08	376.68	41.43	470.85	51.79
12	188.34	22.60	282.51	33.90	376.68	45.20	470.85	56.50
13	188.34	24.48	282.51	36.73	376.68	48.97	470.85	61.21
14	188.34	26.37	282.51	39.55	376.68	52.74	470.85	65.92
15	188.34	28.25	282.51	42.38	376.68	56.50	470.85	70.63
16	188.34	30.13	282.51	45.20	376.68	60.27	470.85	75.34
17	188.34	32.02	282.51	48.03	376.68	64.04	470.85	80.04
18	188.34	33.90	282.51	50.85	376.68	67.80	470.85	84.75
19	188.34	35.78	282.51	53.68	376.68	71.57	470.85	89.46
20	188.34	37.67	282.51	56.50	376.68	75.34	470.85	94.17

SCENARIO No. 3 RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	*188.34*	*11*	*20.72*	*Did not accept Survey No, 1 results. He maintained that his average monthly bill is closer to R20.00*
2	*282.51*	*11*	*31.08*	
3	*282.51*	*10*	*28.25*	*Decides to reduce water usage in bathroom by 1 kL p.m.*
4	*376.68*	*11*	*41.43*	
5	*376.68*	*9*	*33.90*	*Decides to reduce water usage in bathroom by 1 kL + 1 kL in outdoor "Other" p.m.*
6	*470.85*	*11*	*51.79*	
7	*470.85*	*8*	*37.67*	*Decides to reduce water usage in bathroom by 2 kL + 1 kL in outdoor "Other" p.m.*

SCENARIO No. 3
Alberton Municipality
Table 1: Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs +100%		Present Water Costs +150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
1	188.34	1.88	282.51	2.83	376.68	3.77	470.85	4.71
2	188.34	3.77	282.51	5.65	376.68	7.53	470.85	9.42
3	188.34	5.65	282.51	8.48	376.68	11.30	470.85	14.13
4	188.34	7.53	282.51	11.30	376.68	15.07	470.85	18.83
5	188.34	9.42	282.51	14.13	376.68	18.83	470.85	23.54
6	188.34	11.30	282.51	16.95	376.68	22.60	470.85	28.25
7	188.34	13.18	282.51	19.78	376.68	26.37	470.85	32.96
8	188.34	15.07	282.51	22.60	376.68	30.13	470.85	37.67
9	188.34	16.95	282.51	25.43	376.68	33.90	470.85	42.38
10	188.34	18.83	282.51	28.25	376.68	37.67	470.85	47.09
11	188.34	20.72	282.51	31.08	376.68	41.43	470.85	51.79
12	188.34	22.60	282.51	33.90	376.68	45.20	470.85	56.50
13	188.34	24.48	282.51	36.73	376.68	48.97	470.85	61.21
14	188.34	26.37	282.51	39.55	376.68	52.74	470.85	65.92
15	188.34	28.25	282.51	42.38	376.68	56.50	470.85	70.63
16	188.34	30.13	282.51	45.20	376.68	60.27	470.85	75.34
17	188.34	32.02	282.51	48.03	376.68	64.04	470.85	80.04
18	188.34	33.90	282.51	50.85	376.68	67.80	470.85	84.75
19	188.34	35.78	282.51	53.68	376.68	71.57	470.85	89.46
20	188.34	37.67	282.51	56.50	376.68	75.34	470.85	94.17

EXAMPLE FOR SCENARIO 4

Results of Survey No. 1

General Information:

Respondent No.:	ABC
Township:	Alberton / Thokoza
Erf number:	5678
Account number:	-
Number of persons:	6

Household Profile:

Water usage over 1 week		
Indoor usage:	Litres	%
Bathroom	2 760	37.0%
Toilet	950	12.7%
Laundry	500	6.7%
Kitchen	250	3.4%
Other	50	0.7%
Sub-Total	4 510	60.5%
Outdoor usage:		
Garden	1 500	20.1%
Car	250	3.4%
Other	1 200	16.1%
Sub-Total	2 950	39.5%
Total	7 460	100%

Summary of Results:

Average water usage per day	1 066	litres/day
Average water usage per month	32	klitres/month
Equivalent monthly bill	R 62.31	

EXAMPLE FOR SCENARIO No. 4

WATER USAGE SURVEY No. 2

Water usage for selected households in Alberton and Thokoza. A survey being conducted on behalf of the Water Research Commission of South Africa

General Data	
Household	
Respondent No.	*ABC*
Township name	*Alberton or Thokoza*
Erf number	*5678*
Address	*Qwerty*
Telephone Number	-
Date of interview	*18 April 1998*
Number of adults in household (including domestic servants)	*2*
Number of children in household (under 18)	*4*

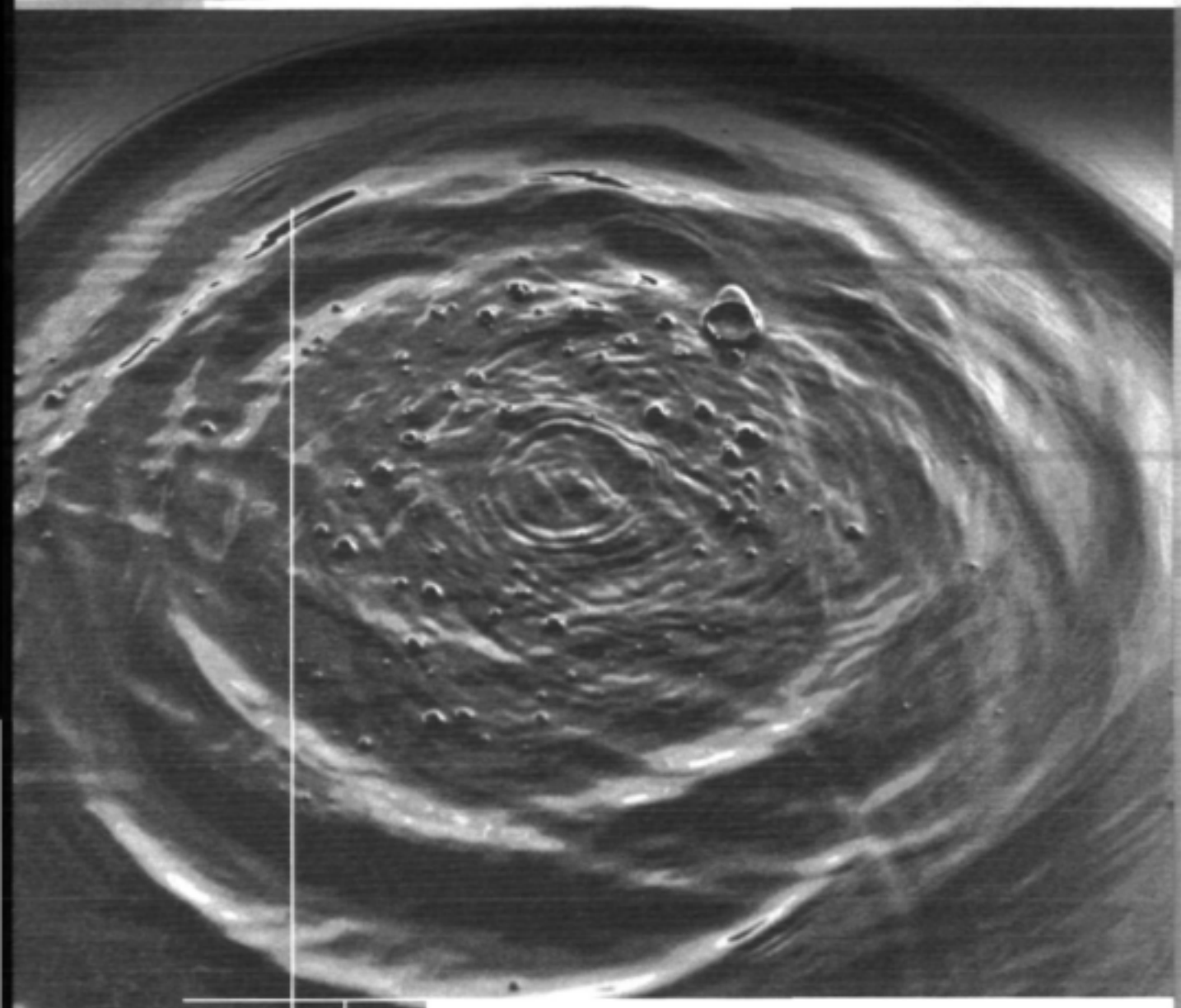
No.	Question	Prompt
1	Discuss and agree on the estimate of the profile of water usage of the household, including the average summer monthly consumption figure and the resulting water bill.	Show the figures obtained in the first survey. Highlight the usage of water in the various categories summarised on the attached sheet. Discuss and record any changes.
2	Would your water consumption change if the price was increased to: *292.09* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 3. If NO record new water bill and proceed to question 4.
3	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
4	Would your water consumption change if the price was increased to: *389.45* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 5. If NO record new water bill and proceed to question 6.
5	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
6	Would your water consumption change if the price was increased to: *486.82* cents per kilo-litre?	Show what the resulting new monthly water bill using Table 1.
Answer	YES / NO	If YES proceed to question 7. If NO record new water bill.
7	What changes in your water usage pattern do you envisage?	Using the prompt cards, discuss and agree on possible ways of reducing water usage. Record the resulting monthly water bill.
End of Questionnaire		

SCENARIO No. 4 RESPONSE TO QUESTIONNAIRE

Question	Average Water Price (cents/kl)	Water Used (kl)	Water Bill (Rand)	Remarks
1	*194.73*	*32*	*62.31*	*Accepts Survey No. 1 results*
2	*292.09*	*32*	*93.47*	
3	*282.51*	*30*	*84.75*	*Decides to reduce water usage in bathroom by 2 kL p.m.*
4	*389.45*	*32*	*124.63*	
5	*376.68*	*29*	*109.24*	*Decides to reduce water usage as follows: 2 kL in bathroom + 1 kL in garden i.e. a total of 3 kL p.m.*
6	*486.82*	*32*	*155.78*	
7	*470.85*	*28*	*131.84*	*Decides to reduce water usage as follows: 2 kL in bathroom + 1 kL in garden + 1 kL in laundry + 1 kL outdoors "Other" i.e. a total of 5 kL p.m.*

SCENARIO No. 4
Alberton Municipality
Table 1: Water Bill for Different Average Prices of Water

Quantity (kl)	Present Water Costs		Present Water Costs + 50%		Present Water Costs +100%		Present Water Costs +150%	
	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)	Average Price (cents/kl)	Water Bill (Rand)
21	188.34	39.55	282.51	59.33	376.68	79.10	470.85	98.88
22	188.34	41.43	282.51	62.15	376.68	82.87	470.85	103.59
23	188.34	43.32	282.51	64.98	376.68	86.64	470.85	108.30
24	188.34	45.20	282.51	67.80	376.68	90.40	470.85	113.00
25	188.34	47.09	282.51	70.63	376.68	94.17	470.85	117.71
26	188.34	48.97	282.51	73.45	376.68	97.94	470.85	122.42
27	188.34	50.85	282.51	76.28	376.68	101.70	470.85	127.13
28	188.34	52.74	282.51	79.10	376.68	105.47	470.85	131.84
29	188.34	54.62	282.51	81.93	376.68	109.24	470.85	136.55
30	188.34	56.50	282.51	84.75	376.68	113.00	470.85	141.26
31	191.64	59.41	287.45	89.11	383.27	118.81	479.09	148.52
32	194.73	62.31	292.09	93.47	389.45	124.63	486.82	155.78
33	197.63	65.22	296.45	97.83	395.26	130.44	494.08	163.04
34	200.36	68.12	300.54	102.18	400.72	136.25	500.91	170.31
35	202.94	71.03	304.41	106.54	405.88	142.06	507.35	177.57
36	205.37	73.93	308.06	110.90	410.74	147.87	513.43	184.83
37	207.67	76.84	311.51	115.26	415.35	153.68	519.18	192.10
38	209.85	79.74	314.78	119.62	419.71	159.49	524.63	199.36
39	211.92	82.65	317.88	123.97	423.84	165.30	529.81	206.62
40	213.89	85.56	320.83	128.33	427.78	171.11	534.72	213.89



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