The Economic Cost Effects of Salinity
HOUSEHOLD SECTOR

VOLUME II

Human Sciences Research Council

WRC Report No 634/1/00

Water Research Commission

VOLUME II

The Economic Cost Effects of Salinity

HOUSEHOLD SECTOR

by the

Human Sciences Research Council

Report to the Water Research Commission and
the Department of Water Affairs and Forestry
on the project
Determining the impact of the salinisation of South Africa's water resources with respect to economic effects

Project Leader: Urban-Econ

WRC Report No.: 634/1/00
ISBN No. : 1 86845 591 2
ISBN Set No. : 1 86845 595 5

EXECUTIVE SUMMARY

1 PURPOSE OF THE STUDY

The Water Research Commission and the Department of Water Affairs and Forestry commissioned an investigation into the economic, social and behavioural impacts that would result due to changes in the salinity of South Africa's water resources.

The aim of the study was, primarily, to develop a generalised methodology model to determine the generic impact of changes in the total salt concentration found in South African rivers and to interpret these impacts in financial, economic and social terms. The resultant model was required to be:

i. comprehensive with respect to addressing the salinity problems
ii. applicable to any salinity situation in any water sector in South Africa.

An important role of the study was to verify the generalised model. This was achieved by applying it to a specific geographic area, namely the Middle Vaal River area. In order to achieve this, actual data gathering exercises were conducted and applied in the conceptual model. Based on this, a process of verification and model adjustments was undertaken, to incorporate the distinctive circumstances pertaining specifically to the Middle Vaal River area.

A generic model, making provision for all possible conceptual elements applicable to salinisation, has thus resulted. The model comprises separate equations representing the different sectors of the economy as well as the natural environment and water feeder systems. An outstanding feature of the model is that it is a generalised model and as such is applicable to any salinisation situation in South Africa.

The value of the study lies in applying the findings of the study in a policy environment. This means that the study results can provide motivation to formulate new policy directives for utilising water resources in a given area.

2 BACKGROUND TO STUDY

There has been a steady increase in the salt content of the Vaal River since 1935. This increase has accelerated markedly since 1965 with a further pronounced effect caused by the droughts prior to 1996. This increase in the salt content affects all water use components exposed to such water.

A major salinity problem exists in the Middle Vaal River area, between the Barrage and Bloemhof Dam. Various options for solving the problem have already been identified. All the options are, however, costly and it is important to quantify the benefits of a reduction in salt concentration in order to justify expenditure on measures to reduce the salinity.

3 OBJECTIVES

Prior to deciding how salinity in the water supply could be managed, it is necessary to determine the total cost of salinity to the economy, namely its direct, indirect and induced cost effects. Costs borne by the various sectors in the economy have to be determined, including the identification of behavioural impacts. The study addresses the impacts of increased level of salinity throughout the economy.

In order to address the uncertainties with respect to the economic implications of salinity, the Water Research Commission identified the need to develop a methodology that can be utilised in difficult salinity situations.

The project was divided into two phases:

- The development of a generalised methodology for the determination of the generic impact of salt concentration of South African rivers and the interpretation of these impacts.
- The application of the methodology to an investigation of the impact of increased salt concentration in the Middle Vaal River.

4 FORMAT OF RESULTS

The research conducted to determine the economic effects of salinity is based on a sectoral approach. The economy had been classified into different sectors and research was conducted separately for each sector. These results were integrated to determine the total economic effects on the economy. On account of the volume of research results, the sectoral research is presented in separate volumes to support the integrated results contained in the main report (Volume I).

Each of the sectoral reports, combining its initial inputs for the generalised model with its findings in the case study, has been separately bound. These are individually available as:

Volume II	:	Household Sector
Volume III	:	Agriculture Sector
Volume IV	:	Mining Sector
Volume V	:	Industrial Sector
Volume VI	:	Services Sector
Volume VII	:	Water Quality Analysis, Feeder Systems, Natural Environment.

As the main report is an integration and interpretation of the background research, variations may occur. The background research should be interpreted as the development of a reference framework by the different specialists and during the course of the study, research findings were continually refined.

5 STUDY APPROACH

The approach followed with the study is based on economic theory by conceptualising sectoral behaviour within the economy. In quantifying these conceptual formulae, surveys were undertaken in the Middle Vaal River study area to obtain the direct costs related to salinity. These direct costs represent only a partial estimate of the total costs of salinity. In order to determine the indirect costs and other spin-off effects, an integrated costing framework had to be set up. This was done by utilising the input-output (IO) technique and a combination of IO applications.

Despite the inherent limitations of the IO technique, it is a very versatile and flexible model to simulate real-world situations. Furthermore, its ability to determine the indirect and induced cost effects, renders the approach as well as the results unique and comprehensive.

The sectors analysed are households, agriculture, mining, industry, services and feeder systems, as well as the natural environment. Conceptual cost formulae were formulated to determine the direct costs and behavioural impacts on costs for different levels of salinity. Based on this background research to set develop these formulae, the research results indicated that both the feeder systems and the natural environment would not incur significant (incremental) costs within the specified salinity range of

200 mg/ℓ to 1200 mg/ℓ Total Dissolved Solids (TDS). These two sectors were therefore not incorporated into the integrated model.

Upon conducting surveys in the study area to determine the direct sectoral costs, a variety of problems was encountered. The most important of these is the fact that many respondents (i.e. sectoral water users) are not aware of the costs of salinity and therefore assigning costs to behaviour becomes rather presumptuous. Behaviour does, however, play an important role in the household and agricultural sectors. With the other sectors, behaviour is driven by technology and production factors.

The survey results obtained in the Middle Vaal River study area were analysed and transformed where necessary, to be integrated into the IO modelling framework. The following approaches were followed:

- Conducting a multiplier analysis that provides a first approximation of the additional costs of salinity due to a change in the TDS and using this to rank sectoral sensitivities with respect to the impact of salinity.

- Setting up a pricing model that simulated the cost increases of different levels of salinity in terms of price changes being passed on as price increases. These price changes are passed on as price increases to all sectors of the economy and can be interpreted as proxies for changes in the Consumer Price Index (CPI) and Producer Price Index (PPI).

- Running an augmented IO model to estimate total additional resource usage as salinity rises. To cost this, a new industry was postulated to enter the economy to combat salinity. A new row and column representative of this industry was inserted into the IO table.

Each of these approaches focused on a different aspect in determining the total cost effects of different levels of salinity.

6 INTERPRETATION OF RESULTS

The results obtained with the IO analyses indicated that the total costs of salinity are significant in the Middle Vaal River study area.

6.1 Direct Cost Effects

The direct costs of salinity to the entire economy of the case study area are established from the mathematical combination of the survey data collected within each individual sector. There are constraints with much of the data, since most interviewees were unable to supply data for any conditions other than those currently being experienced and were generally rather uninformed about salinity and its potential effects.

Despite the drawbacks, the data provided some indication of the direct economic effects of increased salinity. The collected data was centred around 500 mg/ℓ which is the average salinity level presently experienced in the study area. Data for salinity levels below 500 mg/ℓ implies a corresponding saving at these lower salinity levels. A 100 mg/ℓ increase in the TDS to 600 mg/ℓ is expected to effect a R26 million increase in annual direct costs in the study area (refer to Table 1). Increasing the TDS to the highest limit (1200 mg/ℓ) is expected to result in a direct cost of R183 million/a to the region. Conversely, a saving of R80 million/a is anticipated should the salinity drop from current levels to 200 mg/ℓ.

Table 1. Direct Costs of Salinity, (1995 Values in Millions of SA rands)

SALINITY / SECTOR	mg/ℓ TDS						% Contribution at 600 mg/ℓ
	200	400	600	800ℓ	1000	1200	
Mining	(7.309)	(2.212)	0.844	4.863	10.209	17.816	3.17
Business and Services	(1.843)	0.487	1.211	1.707	2.209	2.697	4.55
Manufacturing 1	(0.145)	0.028	0.086	0.123	0.160	0.198	0.32
Manufacturing 2	(2.825)	0.294	1.351	1.993	2.635	3.278	5.07
Agriculture	0.000	0.000	0.439	0.439	0.427	0.503	1.65
Households (suburban)	(35.121)	(11.707)	11.707	35.121	58.535	81.949	43.94
Households (township)	(27.927)	(9.309)	9.309	27.927	46.544	65.162	34.94
Households (informal)	(5.081)	(1.694)	1.694	5.081	8.469	11.855	6.36
TOTALS	(80.251)	(24.113)	26.640	77.253	129.225	183.457	100.00

In considering these direct cost changes the effects can be equated to changes in prices in the economy. The percentage direct impact of salinity abatement on CPI and PPI at a salinity level of 600 mg/ℓ TDS, amounts to 0.0013% and 0.0016% respectively. In effect this implies a relatively small change in these indices which can be equated to changes in inflation.

The greatest direct cost implications occur to the household sector. The direct costs to the households comprise approximately 85% of the total direct costs within the economy under investigation. This is not unexpected, since the household sector comprises the largest group of treated water users in the economy even though the per capita cost increases are not the highest. Conversely, the sectors that use very little water and those using predominantly untreated water are expected to have lower direct cost effects.

Manufacturing 1, where water requires no treatment, has a relatively low water consumption and experiences less than 0.5% of the direct cost of salinity increases at 600 mg/ℓ. By way of contrast, business and services, a relatively large sector within the economy, can be attributed with 4.5% of the total direct costs, while Manufacturing 2 (which treats its water) will face cost increases owing to the costs of treatment. Thus, unsurprisingly, this latter sector experiences 5% of the direct costs to the economy.

Although the mining sector uses large volumes of water in terms of production, much of the water employed is used in re-circulating circuits. Further, this water does not, in general, require a high degree of purification and thus the costs are lower than might otherwise be expected (3%).

Similarly, most of the water employed in the agricultural sector is drawn directly from the river itself. The water costs to agriculture are low, and agriculture is a small sector, occupying a fairly narrow band along the Vaal River. Thus, agriculture occupies a small niche in the economy and its contribution of 1.5% of the total direct costs of the study region, is not unexpected.

6.2 Indirect and Induced Effects

The models employed for the case study calculated the direct, indirect and induced costs to the economy. Since the IO table was closed with respect to households, an allowance was made for the reciprocal relationships between income and consumption, as well as the impact on the economy, resulting from the interdependence of industries in their production process and the behaviour of households. The closing of the IO table effectively added another industry to the economy. Households have a large impact on the economic processes in the region of study and wider, resulting in the expectation of larger impacts than would have been anticipated if the table had been in its open format, considering direct and indirect effects alone.

Ratios of the direct, indirect and induced costs to the direct costs (Direct Cost Multipliers, DCM) determined by means of the multiplier analysis, range from 1 to about 3.3. This implies that the spin-off effects of increased salinity are significant and the direct costs alone are a poor reflection of the cost impacts of salinity.

The ranking of the sectors researched, based on the salinity multipliers, indicates that at relatively low levels of salinity it is the community and other service sectors which will be most adversely affected. At high levels of salinity the gold mining sector will have to incur the highest cost to combat salinity.

The results of the pricing model are expressed in terms of percentage changes in the consumer and producer price indices and essentially represent forward linkages. The impacts have been determined in terms of regional and national impacts. Considering only the impact on the productive sectors, results of the same order as the multipliers provided are found, but with less spread. The direct and indirect DCMs for PPI and CPI are found to lie between 1.36 and 1.84, whilst the direct, indirect and induced DCMs are found to lie between 1.96 and 3.5. It should be noted that the pricing model results indicate variables for a base year expressed in percentages. This implies annual changes in costs or prices.

The percentage total increases in CPI and PPI for salinity levels increases from 600 mg/ℓ to 1200 mg/ℓ can be summarised as indicates in Table 2:

Table 2: Percentage increase in price indices

Salinity abatement by :	CPI: % change	PPI: % change
Productive sectors	-0.008 to 0.01	-0.01 to 0.015
Productive sectors & households	-0.1. to 0.22	-0.11 to 0.26

These changes seem to be small but are significant when related to Rand values in regional and national context. This had been done and the regional and national annual impacts are summarised as indicated in Table 3:

Table 3: Impacts on price indices

IMPACTS	CPI	PPI
National increase		
600 mg/ℓ	R101.5m	R402.6m
1200 mg/ℓ	R647.5m	R2623.4m
Regional increase		
600 mg/ℓ	R7.4m	R18.0m
1200 mg/ℓ	R47.1m	R117.3m

The augmented model was executed using both regional and national IO tables to determine the total cost effects of salinity abatement. Multipliers were calculated for comparison with the other model applications.

The chief outcome was that the DCM was 3.0 for the national case, and 2.6 for the regional case. These figures did not change significantly over the salinity range of 600 mg/ℓ to 1200 mg/ℓ TDS. The difference in the national and regional DCM is due to the differences in structure between the national and the regional economies. Since the IO analysis is based upon coefficients, the actual size of the economies has no influence on the DCMs. Only changes in the size of the input (or technical) coefficients (which in turn reflects a change in the structure of the tables) would influence the outcome.

6.3 Behavioral Effects

The decisions regarding salinity changes made in the mining, business and services and the manufacturing sectors tend to be driven by technology and production regimes. These sectors are likely to make changes to combat the effects of salinity, based purely on the financial implications to the concern. As a result, there are few, if any, unexpected responses to salinity effects and the calculated costs can be accepted as reliable.

During the data collection in the agricultural sector, the cost effects of two possible scenarios, based on management decisions or behaviour, were established. These included a "best case" scenario, where the farmer would 'maintain the current levels of production, regardless of cost, and a second scenario, where the farmer would choose to allow the crop yields to be reduced. This was only done for the hybrid model and the overall costs to the economy were found to be hardly affected by the two alternatives. At the 600 mg/ℓ level, the total costs decrease by less than R0.3 million. The variations are found to be between 0.1% and 0.3% of the overall costs, which are less significant than the probable errors in the data. Thus, the different behavioural responses available in the agricultural sector are unlikely to impact on the total costs to the economy.

The most significant behavioural effects are, however, from the household sector. The responses to increased salinity, while to some extent determined by the need to adapt to the changes, are largely driven by the availability of finances to maintain the *status quo* and overcome the problems arising from increased salinity. These behavioural responses are more likely to appear in those sectors of lower earning potential, and the informal household sector is far less likely to effect changes arising from increased salinity than suburban households. This is borne out by the variance in the data collected.

7 CONCLUSIONS

Based on the output from the model established for the Middle Vaal River region, the economic costs attributable to changing salinity, have been determined.

There exists an effective limit to the cost of salinisation. This is determined by the cost of desalinating the bulk water supply which would represent the most costly option of water treatment. Care must be taken not to allow the costs of salinisation to reach high levels. The viability of desalinating may be increased if selective desalination is applied to the consumer sectors incurring the highest relative costs, although other options should be explored first.

This is obviously a simplistic first-line approach, but it highlights the need to consider bulk or partial treatment of the water supply in the Middle Vaal area as the *status quo* is already 500 mg/ℓ. Behavioural response is particularly important as the quality of the water in the area is already perceived to be problematic.

The results of the study identified the total economic effects of increased salinity levels for the Middle Vaal River area. Based on these findings and the knowledge gained with respect to behaviour, the following observations are made:

- The application of the generic model in the Middle Vaal River area was accompanied by some limitations mainly on account of the undiversified economic structure. Undiversified, in this regard, refers to the strong reliance of the economy on the mining and services sectors. Despite this, very significant information could be obtained on the relative importance of cost effects between the various sectors. To validate these, the model should be applied in a diversified economy such as that of the Gauteng area. More insight concerning relative costs could be obtained on, for instance, the manufacturing sector.

- Differential desalination may be considered. The reason for this is that the household sector has been found to bear relatively high costs in terms of combating salinity, followed by the industrial and services sectors. It may be of value to motivate differential desalination of waters on a purely experimental basis, that is, to study the social and socio-economic benefits to be gained by households if the costs of salinity are decreased. This also implies that sectors that experience relatively low salinity costs may have to continue bearing these.

- It may benefit water users if a salinity awareness campaign were introduced. If end users were made aware of the cost effects, they might choose to behave differently and take informed decisions which may lessen the costs of salinity.

- A specialised database has been established. As part of an awareness campaign, users can contribute towards the refinement and extension of a more comprehensive database that can be utilised when the model is applied elsewhere. Since the availability of the data determines to a large extent the robustness of the model, such a database can contribute significantly to the ease of applying the model.

The interpretation of the findings of this study does not take into account alternative options with respect to water provision. This implies that the costs of salinity have not been related or compared to the situation of utilising transfer water and other allocation options. Furthermore, the results of the study are expressed in direct and spin-off effects and thus any further interpretation or comparison of these results with specific options, should be done in the same manner, namely to refer to total costs.

8 FURTHER RESEARCH

The value of the study lies in the fact that a first approximation of the spin-off effects of salinity on the economy had been determined. Furthermore, an indication of the behavioural costs for specific sectors has been obtained. On account of the specific study area chosen and the difficulties encountered in applying an integrated economic cost model to its specific considerations/circumstances, the following shortcomings may be addressed with further research:

- Application of the model in a relatively diversified economy such as that of Gauteng. In doing this, a more disaggregated model can be executed. Cost effects for more subsectors may then be identified, such as for the leather industry. Based on expectations the total costs of salinity may be higher.

- In applying the model to a chosen study area more significant costs may be identified if the study population is made aware of the problem in advance. The benefits arising from this approach, namely more accurate cost estimates and possibly more correct reporting of behaviour, could outweigh potentially over-reporting, due to increased awareness of the problem.

ACKNOWLEDGEMENTS

The research in this report emanated from a project funded by the Water Research Commission and entitled:

"DETERMINING THE IMPACT OF THE SALINISATION OF SOUTH AFRICA'S WATER RESOURCES WITH RESPECT TO ECONOMIC EFFECTS."

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

Dr D van Driel	Department of Water Affairs & Forestry
Dr G C Green	Water Research Commission
Mr C Swiegers	Department of Water Affairs & Forestry
Mr F C van Zyl	Department of Water Affairs & Forestry
Mr F X Jurgens	Development Bank of South Africa
Mr H M du Plessis	Water Research Commission
Mr J A van Rooyen	Department of Water Affairs & Forestry
Mr M E Mosia	Water Research Commission (Committee Secretary)
Mr P H van Niekerk	Department of Water Affairs & Forestry
Mrs A M du Toit	Water Research Commission
Ms A Belcher	Department of Water Affairs & Forestry

The financing of the project by the Water Research Commission and the Department of Water Affairs and the contribution of the members of the Steering Committee is acknowledged gratefully.

This project was only possible with the cooperation of many individuals and institutions. The authors therefore wish to record their sincere thanks to the following external reviewers:

D van Seventer
Dr J du Pisanie
I G van Gass
Prof C Breen
Prof G Gehrig

TABLE OF CONTENTS

1. INTRODUCTION

1.1. PURPOSE

The purpose of this report is to develop a generalised methodology for the determination of the generic cost impact of salinity and applying this in a case study in the Middle Vaal River Area for the household sector. This report (Volume II) and analysis form part of a larger study to determine the total cost impact of salinity in the Middle Vaal River Area. The main findings of the study are presented in an integrated report (Volume I). This report contains the detail information related to the research and results pertaining to the household sector in developing a conceptual cost formula and verifying this by means of primary research. Essentially this implies a dualistic approach, namely a theoretical hypothesis and the validation of this in a real world situation. On account of the behavioural nature of the household sector as experienced in the study area, the formulae were significantly adjusted.

1.2. BACKGROUND

In 1990 the household or domestic sector accounted for only 12 percent of total water demand in South Africa. It nevertheless represents the second highest sector of water demand after agriculture. By one estimate (Palmer Development Group, 1993) household demand for water will have grown to 17 percent by the year 2010. Given the importance of this sector as a user of water and the large number of consumers it represents, it can be expected that the household sector would bear a significant part of the costs of the salinisation of water.

In Heynike's study (1987) direct costs associated with the household made up 53.2 percent of the total salinisation cost. Heynike identified certain direct costs of salinisation to the household such as the corrosion of plumbing, geysers and household appliances, damage to washable fabrics and the increased use of soaps and detergents. No provision was made for the potential health cost and its impact on the quality of life. Neither did Heynike consider costs associated with compensatory behaviour such as the use of water softening devices, the purchase of bottled water and the increased consumption of carbonated drinks. The study does not make provision for the secondary impact of other sectors on the household. For example, the negative impact of salinisation on industry, agriculture and commerce are likely to produce secondary impacts on the employment and income earning opportunities of household members.

As a result of its social rather than technical nature, the household sector presents major difficulties and challenges in assessing the impact of salinisation. Steffen, Robertson & Kirsten (1989) are skeptical about the possibility of quantifying even the direct costs that Heynike attributes to the household:

> *The whole question of the cost implication of increasing salinity for private households requires careful consideration in any cost benefit exercise. Heynike has identified this sector as being by far the largest in terms of cost but the costs are often difficult to quantify accurately. Heynike has made estimates of these cost some of which might be improved upon with more time and resources than Heynike had available, and some which probably cannot. However these costs will still, in most cases be subject to considerable degrees of uncertainty.*

This study was able to capitalise on the work of Heynike and the subsequent critiques. By taking these into consideration several deficiencies in the works can be overcome. Some costings can be improved on while many (primarily in the field of non-financial and social costs) remain elusive. To ensure that the study was comprehensive and took identified shortcomings into consideration, the work of Heynike and his critics were incorporated into a conceptual framework. The conceptual framework serves to identify what costs need to be included, what cannot be included and, lastly, what costs have been absent from the paradigm.

1.3. CONTENTS OF THE REPORT

Apart from this introductory section, the rest of the report consists of the following sections:

Section Two	:	Conceptual framework
Section Three	:	Methodological considerations
Section Four	:	Case study
Section Five	:	Data analysis
Section Six	:	Input data for modeling
Section Seven	:	Conclusion.

2. CONCEPTUAL FRAMEWORK

2.1. ORIENTATION

The approach adopted in this study is to attempt to identify and include all relevant impacts (whether quantifiable or not) into a conceptual model. A preliminary model of the costs associated with the household is presented (refer to Diagram 2.1). The model makes provision for both private costs (i.e.. costs which are directly incurred by the household) and social costs which include both total household financial costs and other indirect costs borne by the state of by society as a whole. For example medical costs of low income groups are often not borne entirely by the household but usually involve costs to the state supported health system. Similarly degeneration of the financial position of the household can itself impose costs on the welfare system. This may result in social discontent, crime, and even out-migration. Furthermore, non-financial costs such as poor health are likely to have an impact on the productivity of the community as a whole.

In relation to private household costs, a distinction is made between financial and non-financial costs. Financial costs include items like the corrosion and scaling of plumbing and appliances, as well as other expenses like the increased consumption of detergents and soaps. Non-financial costs principally involve the impact of salinity on the quality of life of the household. These costs include both the impact of the health of members of the household as well as aesethic impacts relating to the taste, smell and appearance of water.

Quality of life is a concept which reflects the overall conditions of the individual relative to his/her values. Quality of life assessments, however, should go beyond objective social conditions and ascertain the meaning of these conditions for the individual. Because the quality of life of individuals is partly subjective, individual attitudes, perceptions and values should be surveyed in quality of life assessments. Since it is nearly universal that people want more rather than less (in terms of income, housing, friendships, access to services, etc.) objective information can be used to indicate the direction of change in individual quality of life.

Clearly the financial costs imposed on households also have implications for their quality of life in so far as additional household expenses would necessarily reduce the household budget. These impacts need to be seen in relationship to the total expenditure of the household and the trade-offs made with available resources. Non-financial or quality of life costs may thus also have financial implications. As indicated above the deterioration of household health may have cost implications to both the household and the state. Similarly aesthetic considerations relating to the taste of water may lead to costly compensatory behaviour such as increased consumption of bottled water and cold drinks.

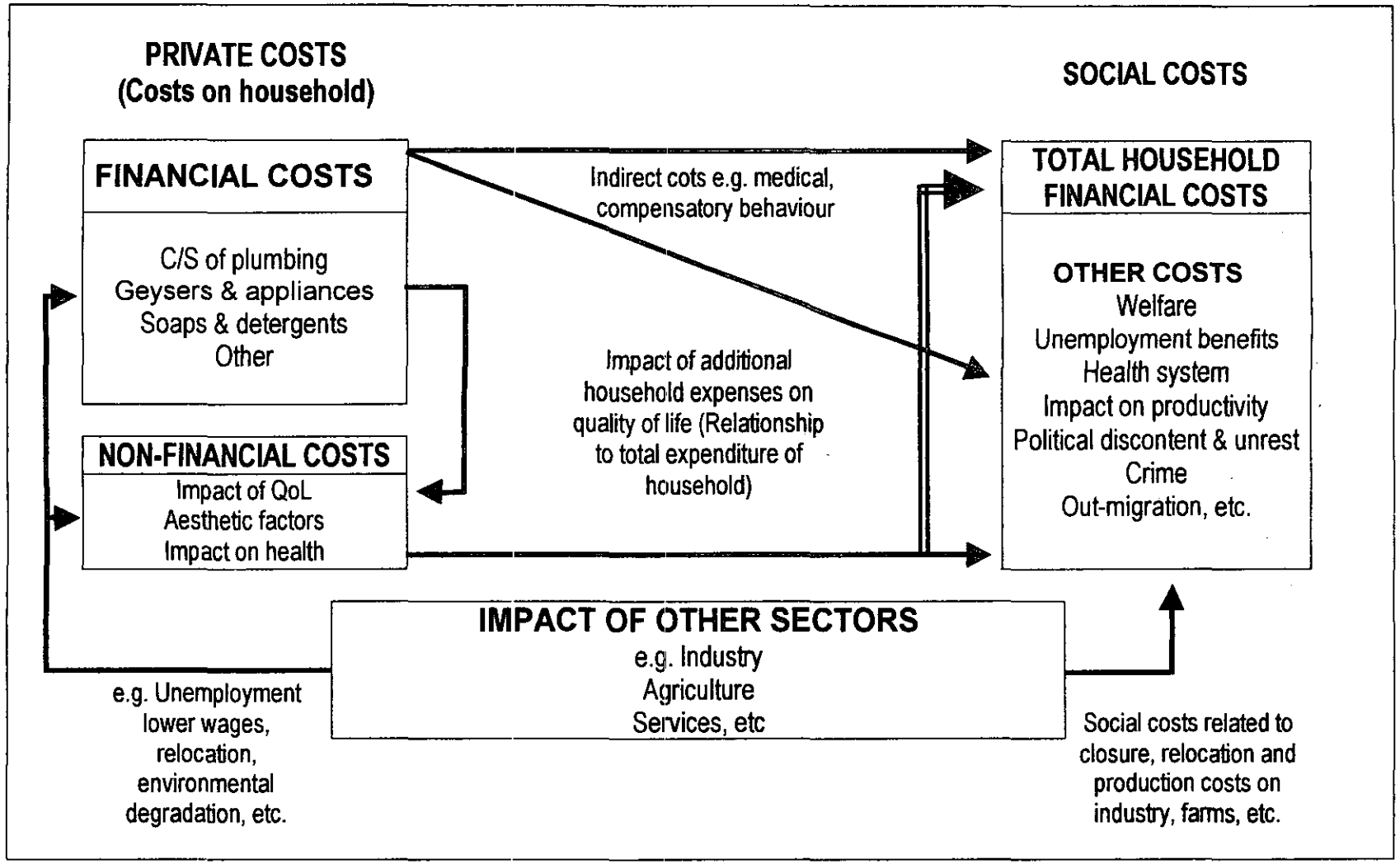
A further dimension that needs to be taken into account when estimating costs is the impact of salinisation on sectors other than the household. The closure, relocation or reduced profitability of industries, services, farms etc. have implications for the employment and wage levels of households. Similarly degradation of the environment resulting from water salinisation could have financial implications for the household and for the quality of life of communities.

2.2. FINANCIAL COSTS

2.2.1. Plumbers, geysers and other household appliances

Corrosion can be considered a direct cost to a household exposed to water of increased salinity.

DIAGRAM 2.1: CONCEPTUAL FRAMEWORK



Metal piping, geysers and other household appliances may be subject to rates of corrosion dependent on the materials used for their construction. Copper pipes, zinc, galvanised steel, cement mortar pipes, organic pipe lines and bare steel pipes are all affected to different degrees. Plastic piping is not affected by increased salinity in so far as corrosion is concerned. The rate of corrosion is also affected by the actual composition of the water. Most metal household pipes are made of copper or galvanised steel. There is some information available on the relationship between water salt concentrations or conductivity and the corrosion rates of zinc. The effect of Sulphate Reducing Bacteria (SRBs) need not be considered in households, since they generally require stagnant water conditions.

Increased corrosion will lead to an increase in maintenance and replacement costs. In relation to geysers it must be borne in mind that the geyser includes a magnesium anode. The anode is consumed to protect the geyser from corrosion. The rate of consumption of the anode is itself dependent on the composition of the water. As total dissolved solids (TDS) increase the life of the anode is reduced as the anode needs to be consumed faster to better protect the geyser itself. It can be assumed that as far as corrosion is concerned, the life of the geyser itself is likely to be relatively constant in the TDS range examined. The generic formula for household costs relating to **plumbing and geysers** can therefore be expressed as follows:

$$Cost = C_{pipe}R[salt]+(geyser_{current}XC_{geyser}/Geyser_{newTDS})+(Anode_{current}XC_{anode}/Anode_{newTDS})$$

Where:

$C_{pipe}R[salt]$ = cost of replacing pipes at a corrosion rate determined by the salt concentration

$Geyser_{current}$ = lifespan of geyser under current conditions

C_{geyser} = cost of replacement of geyser

$Anode_{current}$ = lifespan of anode under current conditions

C_{anode} = Cost of replacing anode

$Geyser_{newTDS}$ = Life of geyser at anticipated TDS levels

$Anode_{newTDS}$ = Life of anode under current conditions

Similar conditions apply to household appliances that are dependent upon water for their operations these include washing machines, electric kettles and steam irons, although Steffen et al question Heynike's assumptions that the salinity of water shortens the lifespan of such appliances. Except for "discussions with manufacturers" they provide no evidence to support their claims. Manufacturers have vested interests in the assertion that their appliance can withstand any expected concentration of salts. The impact of the use of non-corrosive materials in modern appliances has to be investigated by ascertaining their impact at the level of household behaviour. Against the background of these competing claims the generic formula for **household appliances** is similar to that for geysers, namely:

$$Cost = Appliance_{current}-Appliance_{newTDS}XC_{appliance}/Appliance_{current}$$

Where:

$Appliance_{current}$ = Lifespan of the appliance under current TDS levels

$Appliance_{newTDS}$ = Lifespan of the appliance under new TDS levels

$C_{appliance}$ = Cost of the appliance

Conceptually, the costs associated with the corrosion of plumbing and geysers could be represented as follows.

$Cost = pipe_{maintenance} + geyser_{maintenance} + pipe_{replacement} + geyser_{replacement}$

Where:

$pipe_{maintenance}$ = cost of maintaining pipes

$geyser_{maintenance}$ = cost of maintaining geyser

$pipe_{replacement}$ = cost of replacing pipes

$geyser_{replacement}$ = cost of replacing geyser

To complicate matters even further paralleling the effect of corrosion on appliances etc, is the related but distinct costs incurred as a result of scaling. Under saline conditions pipes, geysers etc. exhibit a degree of calcification or accumulation of scale that leads to reduced efficiency and, ultimately, to total blockage/ breakdown. Each generic formula should thus be supplemented by an equivalent that reflects the cost of replacing or repairing appliances damaged by excessive scaling as well as the costs imposed by attempts to pre-empt the build-up of scale.

2.2.2. Soaps, detergents and softeners

Steffen et al relied on inputs from manufacturers of soaps to question Heynike's assumptions about the *impact of water salinity on soaps and detergents. The responses obtained indicated that rather than* being interested in the scientific issues of the impact of salinity the manufactures may have been defensive about the effectiveness of their products. For example, the report maintains that the writer's view was supported by "discussions carried out with one of the major manufacturers of detergents who stated that their formulation is made to cope with the most saline conditions encountered in the country and is the same in all areas, regardless of water quality". The argument that "users tend to overdose their cleaning materials to such an extent that the salinity of the water they are using does not matter" appears to miss the point that "overdosing" is more costly and may be further aggravated by increased salinity. The issue highlights the need for comparative behavioural studies which can compare levels of overdosing under high saline and "normal" conditions.

The generic formula for the use of **soaps, detergents and softeners** *would therefore be as follows:*

$$Cost = (Soap_{newTDS} - Soap_{current}) \times C_{soap}$$

Where:

$Soap_{newTDS}$ = Amount of soap required under new TDS levels

$Soap_{current}$ = Amount of soap under current TDS levels

C_{soap} = Cost of soap

There is general agreement that because of its synthetic composition, the economic impact of salinity on detergents is considerably less than that for soap. Detergent manufacturers also add anti-corrosives to their detergents as a matter of course. Although it is not possible on the basis of existing information, to predict with any degree of precision the additional amounts of soap required at specific TDS levels, it is generally agreed that the impact of hard water on soaps can be considerable. Heynike was aware of the different impacts of soaps and detergents. He predicted that at 800mg/ℓ TDS users would require 2.7 times more soap than at 300mg/ℓ. Additional detergent requirements on the other hand were only 10 percent for the same TDS levels. The objections of Steffen et al are thus of lesser relevance.

Based on Heynike's estimates and rough calculations using Central Statistical Services' (CSS) 1990 Survey on Household Expenditure it would appear that the financial losses to households due to the impact of salinity on soaps and detergents would be significant (R69 per annum per household for soap and R10 for detergents). It would thus be essential to retain this dimension in any model.

2.2.3. Washable fabrics

Heynike allowed for a 2.5 percent reduction in the life of washable fabrics but it is not clear from the report how this estimate was derived. At the time of his study only rough estimates of the impact of TDS on fabrics were available.

The generic cost formula is thus:

$$Cost = (Fabrics_{current} - Fabrics_{newTDS}) X\ C_{fabrics} / Fabrics_{current}$$

Where

$Fabrics_{current}$ = Lifespan of fabrics under current TDS levels

$Fabrics_{newTDS}$ = Lifespan of fabrics under new TDS levels

$C_{fabrics}$ = Cost of fabrics

While it is generally agreed that repeated (or prolonged) laundering with hard water can have a deleterious effect on the tensile strength of washable fabrics, consensus exists among those consulted that it would be extremely difficult to quantify this effect. In a study in the U.S.A. Black and Veatch allowed for a 4.5 percent reduction in the life of washable material for an increase in TDS from 250 to 1 750mg/ℓ. This was based upon "judgment, field interview data, background experience, etc." Heynike on the other hand used a reduction of 2.5 percent for a change in TDS from 300 to 800mg/ℓ although it is not clear how he arrived at this figure (except perhaps via an extrapolation of Black and Veatchs' figure).

Allowing for a 3.5 percent reduction in the lifespan of fabrics (i.e. the mean of the two estimates above) and an average household expenditure of R1 234 per annum on clothing, additional costs to households would amount to an average of R43 per annum. Although this amount is relatively substantial, the estimates for deterioration remain tenuous. Measuring the impact of salinity on fabrics is more problematic than may appear at first. The primary impact of increased salinity is less on the longevity of fabrics than on aesethic qualities. Abrasiveness and discoloration probably have a more important impact on expenditure than the reduction in fabric strength. Households can adapt to the situation in various ways. These adaptations could include increasing use of fabric softeners, moving away from synthetic fibers or increasing consumption of bleaches. This behaviour raises the prospect of double-counting in that costs can be reflected both as a reduction in fabric longevity and as an increase in expenditure on detergents, softeners, bleaches, etc. A more accurate picture may arise from the observation of household behaviour.

2.2.4. Quantification

This section refers repeatedly to generic formula for calculating costs. However, the application of the formula depends on the meeting of numerous (and onerous) assumptions. The formulae essentially treat the costs attributable to salinity as an additional cost over and above a basic "normal" rate. To perform these calculations, it is necessary to know the base rate (of depreciation and consumption for each component) and a marginal rate attributable solely to the increment in salinity. Viewed from a technisist paradigm this is essentially reasonable as it should be possible to calculate the impact of increased TDS on corrosion, scaling etc. This, however, assumes knowing the existing rate of consumption or depreciation - a factor determined less by physical conditions than by social ones.

Actual rates of consumption/ depreciation depend less on time (as implied by the formulae) than on the frequency of their use. The depreciation of geysers, for example, depends less on the age of the geyser than on the volume of water heated by the instrument. Depreciation and consumption rates should thus reflect household behaviour as determined by economics, fashion, culture, environmental circumstances etc. Setting a baseline rate of depreciation for geysers entails knowing to what use specific socio-economic groups put their geysers. Relatively affluent households habitually use their geysers for bathing, dishwashing and laundering of clothes. The geyser may also be used to supply hot water on demand for luxuries like automatic dishwashers. Poorer households, even if they do have access to an unbroken supply of electricity, probably have to be far more discriminating in how often and how abundantly they use heated piped water. The application of a single (time dependent) rate of depreciation to geysers for both these groups will inevitably lead to erroneous estimates. Such limitations apply equally to the formulae for soap and detergent consumption etc. The derivation of the required baseline information forces studies away from technical detail to examinations of household behaviour.

2.3. NON-FINANCIAL COSTS

Non-financial costs incurred by the household can be subsumed under two principal issues - health risks and aesthetic factors. These two issues are closely related in a number of respects and are clearly distinguished from the financial costs in that their principal impacts are on people rather than on the goods they own. This distinction is of vital importance because it has major implications for both the complexity of costs involved and for the methodology in calculating those costs.

2.3.1 Health costs

The greatest health risks to humans in drinking water is from micro-biological contaminants. Health risks associated with chemical contamination differ in that they seldom lead to acute health problems, and with the exception of massive accidental contamination by chemical toxins, usually cause adverse health problems only through long periods of exposure. This of course complicates assessments of the risk and costs associated with salinisation and other chemical contamination.

A recent review of the consideration of health in environmental impact studies (Arguiaga, Canter & Nelson, 1994) shows that health risks have traditionally been given little attention in environmental impact studies.

Health issues are more appropriately conceptualised in terms of *risk* rather than *cost*. If, for example, a specific level of TDS constituted an unacceptable health risk, this risk would remain unacceptable regardless of whether actual costs were high or low.

A more appropriate approach to decision-making on water quality in relation to public health (and aesthetic acceptability) is the use of water quality standards or guidelines rather than decision-making through cost-benefit analysis. The primary aim of such guidelines is the protection of public health, and to a lesser extent to ensure public acceptability in terms of aesthetic issues. Although the World Health Organisation (WHO) does not consider its guidelines as mandatory (local or national environmental, social, economic and cultural conditions have to be taken into account), it states that "considerations of policy and convenience must never be allowed to endanger public health".

Water guidelines and standards provide a decision-making device based on considerations of public health *over and above* any cost-benefit analysis that might be undertaken in relation to the quality of water supplies.

A general model does not lend itself to sensitivity to the specific constituents of drinking water and their potential health effects. This suggests again that the alternative methodological approach of testing water for specific constituents and calculating health risks within these parameters, rather than attempting to include health effects within a general costing model, would be the most viable.

While a methodology for estimating health costs has not yet been worked out, it is envisaged that estimates would be generated in terms of specific proportions of the population whose health will be at risk when exposed to specific concentrations of TDS - assuming of course that the necessary guidelines exist or relevant epidemiological data is available. Health costs include both costs to the household and potential costs to the state or community.

Because health hazards are dependent upon prolonged exposure, assessments of risk have to take into consideration cumulative effects over a lifetime of consumption. Health risks are also associated with the specific constituents of water (rather than some general measure such as TDS) and one therefore has to take into account the potential additive effects of specific chemicals with similar toxic properties. Furthermore, both the rates of intake of water and the impacts on an individual consumer can differ. Water intake is likely to vary with ease of access to water, climate, physical activity and culture. Similarly, certain individuals such as infants, children, the aged and the sick may be more sensitive to contaminants. The cumulative effects of chemicals also introduce the complication that water is not usually the sole source of human exposure to the chemicals found in water. An obvious case is sodium chloride (table salt), but a number of other chemicals (including sulphates) are commonly found in food.

Information relating to health risks associated with TDS and its common chemical constituents is presented in Table 2.1. This information was compiled from the *"Guidelines for Drinking-Water Quality"* of the WHO (1993), the Department of Water Affairs and Forestry (DWAF) *"South African Water Quality Guidelines"*, the Department of *Health's "Water Quality Criteria for South Africa"*, and the National Institute for Water Research's *"Proposed aesthetic/physical and inorganic drinking-water criteria for the Republic of South Africa"* (Kempster & Smith, 1985). The predicted levels of the major chemicals at three levels of TDS for the Middle Vaal area as calculated in the water quality analysis are also provided for comparison.

In relation to TDS, the WHO maintains that reliable data on the possible health effects associated with TDS is "not available" and offers no health guideline for this general measure. The Department of Water Affairs guidelines suggest that health effects are "minimal" below 2 000mg/ℓ TDS, but this assertion is questioned by Kempster who maintains that against the background of the high incidence of heart attacks, the associated problems of high blood pressure and kidney failure in South Africa, it is undesirable to have water with a TDS in excess of 1 000mg/ℓ. In short it would appear that with the disagreement and uncertainty surrounding the health impact of TDS/electrical conductivity, it would not be possible to associate specific costs with this general measure of salinity.

TABLE 2.1: HEALTH RISKS ASSOCIATED WITH SALINITY CTDS

CHEMICAL	Predicted level of specific chemicals at TDSmg/ℓ			Health risks or impacts
	1 200 TDS	900 TDS	700 TDS	
TDS	-	-	-	WHO has no health-based guideline in relation to TDS as reliable data on possible health effects are not available. DWAF Water Quality Guidelines maintain that health effects are minimal at concentrations below 2 000 – 3 000mg/ℓ TDS, but this statement is questioned by some experts.
Na	135	99	76	WHO has no health guideline for sodium as they maintain that no firm conclusions can be drawn about the health effects of sodium. However, not all authorities concur on this point and the Department of Health has recommended a health limit of 100mg/ℓ for sodium. Water with a TDS of above 900mg/ℓ in the study area may therefore involve potential health risks, although this is likely to be controversial.
Ca	131	99	78	Besides the inverse association between calcium intake and heart disease, calcium is also essential to bone development and helps *to reduce the toxic effects of heavy metals. See also hardness, below. The Department of Health considers concentrations of calcium* below 200mg/ℓ to involve no health risks.
Cl	128	95	72	WHO has no health guideline for chlorine. According to the department of Health guidelines, no health risks are involved in concentration below 250mg/ℓ.
SO_4	544	389	286	No WHO health-based guideline is provided, but it is pointed out that in high concentrations, sulphate can result in catharsis, dehydration and gastro-intestinal irritation. WHO recommends that health authorities be notified where drinking water contains concentrations of sulphate in excess of 500mg/ℓ and the Department of Health guidelines state that sulphate concentration of above 600mg/ℓ would have a laxative effect on the majority of users. The NIWR recommended limit and maximum permissible limit be at 200 and 600mg/ℓ respectively.
Mg	66	50	38	Although magnesium is an essential nutritional element, high concentrations can cause diarrhoea in new users. The NIWR guidelines give 70mg/ℓ as "recommended limit" and 100mg/ℓ as the "maximum permissible level".
HARDNESS	605	455	354	WHO points out that there is an inverse relationship between the hardness of drinking water and cardiovascular disease and offers no health guidelines.

The same ambiguities exist in relation to the specific constituents of TDS. In relation to the predicted levels of specific constituents of water from the Middle Vaal area at different levels of TDS, it would appear that sodium and sulphate concentrations at the upper limits of the range might provide grounds for concern. The impacts, especially for sodium, however, remain controversial since some water softeners can add significantly to the sodium content of drinking water (WHO, 1993:55). Although the Department of Health maintains that sulphate concentrations above 60mg/ℓ would have a laxative effect on most users, it is far more difficult to predict impact at lower concentrations. The presence of magnesium which also has a cathartic effect, is a further complication to be taken into account. However, even if it were possible to predict the consequences of sulphate concentrations more exactly, the problem of attaching economic values to these effects would remain.

In summary, therefore:

A number of factors, including the existing level of epidemiological knowledge, the cumulative impact of chemicals, other sources of intake, differing quantities of water consumed, and differing sensitivities to specific chemicals, make it difficult to measure and predict the impact of salinity on health.

The need to consider the impact of specific constituents of water (rather than those of some general measure such as TDS) does not easily lend itself to calculating costs in the content of a simulation model. Even when specific constituents are taken into account, considerable uncertainties exist as to impact.

If these uncertainties did not exist and it was possible to specify exact outcomes of different levels of salinity, it is ethically and methodically debatable whether the calculation of such costs would, on their own, provide a sound basis for decision-making. Clearly, certain medical and other costs would be incurred by both the individual or household and the state as a result of a decline in public health, but it is not clear if such costs are of central relevance to the issue. How, for example, does one place an economic value on the loss of life due to salinity? The question is meaningless, because a totally different logic of assessment comes into play.

2.3.2. Aesthetic acceptability and compensatory behaviour

Aesthetic acceptability involves impacts on both quality of life and indirect financial and health costs associated with compensatory behaviours. At least two potential issues are involved in relation to compensatory behaviours associated with the aesthetic unacceptability of water.

Use of alternative sources of water can involve financial costs, such as the purchase and maintenance costs of water softening devices, the purchase of bottled water, the collection of water from more distant sources, or even greater reliance on cool drinks, etc. The costs that households are prepared to take upon themselves in order to compensate for aesthetically unacceptable water provide some indication of the value households attach to aesthetic issues.

In other cases, consumers might make use of alternative water sources (or practices) which are unsafe in terms of health. Aesthetic acceptability can therefore involve health risks.

It would appear that where conventional water supplies have a high salt content the practice of using groundwater of unknown quality as an alternative to unpalatable tap water, is relatively widespread in poor communities. Such practices not only hold considerable health threats, depending on the quality of the alternative water sources, but also tend to undermine the whole basis of the installation of more sophisticated water systems in such communities. For example, when a community makes use of unsafe ground water instead of using water from a installed standpipe system, the rationale for installing the standpipe system is undermined. Therefore in addition to the health costs that might be incurred from drinking unpotable water, two additional categories of costs may be involved.

Where a water supply system has been installed the costs of installing and maintaining the system are at least partially wasted because a major purpose of installing the supply system is not fulfilled.

Secondly, if a water supply system has not been installed, the high TDS content of the water supply and the anticipated reaction of the community to the taste of the water may act as a disincentive to install an improved water system. In turn the failure to install an improved water system would have a number of potential detrimental consequences, including a loss in regard to the quality of life of the community, loss of time in collecting water from more distant sources, increasing discontent of the community in relation to perceived inequalities.

Although aesthetic factors relating to the public acceptability of the taste, colour and smell of drinking-water are of secondary importance when compared with health risks, the aesthetic quality of water should not be disregarded. For example, the WHO points out that:

> *Source water that is aesthetically unsatisfactory may discourage the consumer from using an otherwise safe supply. Furthermore, taste, odour, and colour may be the first indication of potential health hazards (WHO, 1993:4).*

Aesthetic factors may also involve financial costs to households when they attempt to compensate for unpalatable water by relying to a greater extent on alternative sources of water. In some respects potential health risks may also be incurred, as in the case of water softeners which increase the sodium content of water.

As with health risks, aesthetic factors directly impact on people and this introduces complications that are not usually present with impact on inanimate objects like geysers and household appliances. The acceptability of the taste, odour and appearance of water is culturally mediated. Habit plays a role in that people who are accustomed to a specific taste in their drinking water are usually more tolerant of this taste than newcomers to the area. Responses to aesthetic factors may also be expected to be more varied and less predictable because they are subject to individual preference as well as social, economic and cultural considerations.

For example, whether a person will make use of an alternative (and potentially unsafe) source of water because of the aesthetic features of existing supplies will depend upon a number of factors, including the existence of convenient alternative sources of water, the person's awareness of potential health risks, and the extent to which the people have had the opportunity to become accustomed to the taste of the water. In the Northern Transvaal, for example, it has been found that migrant labourers who spend long periods away from home and have become accustomed to water from other sources, are more likely to resort to alternative sources of water if they find the conventional source unpalatable (Haupte, 1995).

Clearly, these are complex relationships which would require considerable research in order to quantify accurately. For the purpose of modelling the costs of salinisation, two types of conceptual formulae might be used:

Cost of specific compensatory behaviours x number of households using this compensatory behaviour.

Health costs associated with alternative source of water + percentage of costs of installing an improved water system.

In Table 2.2 information relating to aesthetic impacts associated with TDS and its chemical constituents for the Middle Vaal river area is presented. In relation to TDS as a general measure, it would appear that major problems with palatability are more likely to occur at levels greater than 1 200mg/ℓ. This does not necessarily rule out negative responses to the *specific* constituents of the dissolved solids. In relation to the predicted levels of constituents for the Middle Vaal region, it would appear that the levels

of sulphates and water hardness, particularly at TDS levels between 700 and 1 200mg/ℓ, would result in a detectable taste in the water. It is not clear, however, how consumers would respond to this taste, particularly if the sulphate content and hardness of the water increased gradually.

Given an upper limit of 1 200mg/ℓ TDS and the WHO guideline that water "becomes increasingly unpalatable at TDS levels greater than 1 200mg/ℓ", the economic (and quality of life) impacts as a result of aesthetic unacceptability are likely to be minimal in relation to this general measure. The specific constituents of water can only be taken into account in relation to water analyses for specific areas. It is therefore recommended that this variable be excluded from the model for the present range of TDS levels.

2.4. DIFFERENTIAL IMPACT ON HOUSEHOLDS

The diversity of people affected by increased salinity and the myriad ways in which they could respond underscores the need to be both cognisant of the differences yet able to differentiate between the most important behavioural categories. The household sector can be primarily differentiated in terms of levels of income. Additional discriminators such as water supply systems, housing types, population groups, location/level of urbanisation, electricity supply and education are also potentially significant.

Against this background and the need to be economical in relation to the variable that would be included in the interactive model, it was felt that a concept such as standard or level of living might more appropriately meet requirements. Standard of living has been used to denote (i) the conditions in which people actually live, as well as (ii) the conditions of life to which people aspire but which they may not yet actually enjoy, and (iii) certain desirable standards such as minimum wages, working hours, levels of consumption, etc. which are defined by external authorities (see for example Gould, J & Kolb, w l, 1964). The first meaning in terms of actual conditions of living, is most relevant to the current purposes, although aspirations and desired standards might also be relevant in relation to impacts on the quality of life. In accordance with current practice, the term *level of living* will be used to denote actual conditions.

The major advantage of a concept like standard/level of living is that it is able to encompass a broad range of different dimensions such as housing, services, consumption rates, etc., as well as cultural orientations that relate to levels of consumption. However, the very complexity of the concept is also its greatest weakness, in that it is difficult both to quantify and to justify inclusion or exclusion of its various dimensions.

These problems may be overcome by (i) either adopting or creating an appropriate index for level of living, or (ii) using an appropriate indicator such as income or area of residence as a proxy for level of living.

While there are various possible ways of measuring standard of living, the most convenient would be to use income or a close proxy.

A hypothetical representation of the differential implications of salinisation for households with a high, medium or low levels of living or incomes is presented in Table 2.3 For example, households with a high level of living are likely to have more extensive plumbing systems and geysers, more extensive ranges of household appliances and both extensive and more diverse use of soaps and detergents. At the other end of the level of living scale, households are likely to have only rudimentary plumbing and geysers if they have any at all.

TABLE 2.2: AESTHETIC IMPACT RELATED TO TDS (SALINITY)

CHEMICAL	Predicted level of specific chemicals at TDSmg/ℓ			Aesthetic impact
	1 200 TDS	900 TDS	700 TDS	
TDS	-	-	-	The WHO maintains that TDS can have a profound effect on the taste of water. At 600mg/ℓ TDS water is generally considered to be palatable, but "becomes increasingly unpalatable at TDS levels greater than 1 200mg/ℓ". According to the NIWR guidelines, the maximum permissible limit for electrical conductivity is 300 mS/m or 1 950mg/ℓ TDS.
Na	135	99	76	At room temperature, the average taste threshold for sodium is about 200mg/ℓ.
Ca	131	99	78	See "hardness" below.
Cl	128	95	72	Chlorine concentrations above 250mg/ℓ can give rise to a detectable taste, but consumers can become accustomed to concentrations above this amount (WHO).
SO_4	544	389	286	Sulphate can cause a noticeable taste in drinking water, depending on the nature of the associate cation. Taste thresholds range from 250mg/ℓ for sodium sulphate to 1000 mg// for calcium sulphate (WHO).
Mg	66	50	38	Magnesium imparts an unpleasant taste to water in concentrations above 100 mg//.
Hardness	605	455	354	As the WHO points out, public acceptability of the degree of hardness of water may vary considerably from one community to another, depending on local conditions. The taste threshold for the calcium ion is in the range 100-300mg/ℓ. However, in some instances a water hardness in excess of 500mg/ℓ is tolerated by consumers.

TABLE 2.3: DIFFERENTIAL IMPLICATIONS OF SALINITY ON HOUSEHOLDS

VARIABLE	LEVEL OF LIVING/INCOME		
	HIGH	**MEDIUM**	**LOW**
Plumbing	Extensive plumbing system	Less extensive plumbing system	Rudimentary system or none
Geysers	Larger and more expensive geysers	Smaller and less expensive geysers	None
Other household appliances	Extensive range of relevant household appliances	Less extensive range of relevant household appliances	Few or no relevant household appliances
Soaps, detergents and softeners	More extensive and diverse use of detergents, soaps and softeners	Less extensive and less diverse use of detergents, soaps and softeners	Greater reliance on soap for range of cleansing needs
Health costs	Although water consumption is physiologically determined and intake is therefore not likely to differ between classes, higher income groups are likely to have greater access to alternative water sources and to have higher levels of health in general and may therefore be less vulnerable to illnesses resulting from salination		
Quality of life: Aesthetic issues	Greater awareness of salinisation so more likely to compensate	Lesser awareness and less compensatory behaviour	Least awareness and least access to compensatory alternatives
Quality of life: Impact on household budgets	Although costs incurred by higher-income households are likely to be greater in absolute terms the relative impact is likely to be greater for poorer households		

As a result of the general lack of resources and access to services some low income households may also be more vulnerable to illnesses resulting from salinisation, and although their costs might be lower than those of more affluent households, they may feel the impact on household budgets and quality of life more severely than their affluent counterparts. Although the impact of salinisation on quality of life would be difficult to quantify, it may be possible to quantify the cost of compensatory behaviour for the three living levels.

2.5 CONCLUSION

The conceptual framework indicated above succeeds in indicating, broadly, any study of this nature can offer. The model is however largely informed by its technicist precedents. These precedents inform the questions that are asked about increased salinity and are limited in so far as they fail to raise certain questions. These include questions like:

What opportunities are precluded as a result of increased salinity? Opportunities forgone are costs to households that may be substantial. For example households may be unable to use solar heaters or certain types of water sprinkling systems and thus have to revert to relatively inefficient alternatives.

The effect of corrosion and scaling may be more substantial in household "appliances" not considered under any of the above headings. Costly repairs are frequently demanded to household appliances like *swimming pool filters and motor car radiators.*

To improve on work already completed any methodology adopted would have to capture these and other factors not yet considered. This study used surveys of households and service providers to identify the full range of costs that are or could be incurred by households. The surveys were also be used to identify the behavioural responses of households and, as far as possible, quantify the costs involved thereby allowing for a far more comprehensive perspective on the issue.

Although the reservations pertaining to quantification of costs derived from the health and aesthetic impact remain strong, it is possible to reduce the degree of uncertainty. By identifying and describing the compensatory behaviour of individuals and households it will be possible to move some of the debate from pure speculation to one constrained by informed parameters.

3. METHODOLOGICAL CONSIDERATIONS

3.1. INTRODUCTION

Developing a policy on the desalination of household water is undermined by difficulties in accurately calculating the cost to households of increasing water salinity. To date, attempts to estimate such costs suffered a common drawback - they rely on broad presumptions about the behaviour of households. Most of these estimates are based on "technical" models which typically rely on assumptions of rational economic behaviour by households, leading to idealised cost/benefit analyses. The relevance of the assumptions (and thus of the deductions) can therefore easily be brought into question. This study seeks to more accurately measure the cost by using an analysis of adaptive behaviour. The method raises specific methodological problems which are addressed, in part, in the subsequent subsection. This discussion is theoretical in nature and is presented to further explain the methodology.

To be fair, the reasons for the assumptions underlying the technicist approaches are understandable. It is difficult to reliably measure the costs of salinity or to isolate behavioural adaptations that can be unambiguously attributed to the same. Under these conditions the adoption of strategic assumptions is often the only viable avenue. Difficulty in estimating the cost to households of increased salinity include:

- **The magnitude of the cost impact:** Generally speaking the changes in household expenditure that can be attributed to salinity are small, incremental adjustments to items (like detergents, water and electricity) already consumed in some quantity. With regard to capital items, increased salinity may merely shorten the life of the appliance or item rather than dramatically curtail its utility.

- **The marginal nature of the increase in salinity:** Households are rarely confronted with a sudden, noticeable increase in water salinity. Rather, the increase takes place over a prolonged period during which household behaviour adjusts to match the requirements of the changing water salinity. Costs associated with these changes in behaviour are incorporated into gradual adjustments over time. Consequently households may be oblivious (or at least only partly aware) of how they have adjusted to the increased salinity.

- **The oblique impact of factors affecting expenditure on items affected by salinity:** Factors impacting on household expenditure are diverse and manifold. When it comes to household items that are potentially affected by salinity, this diversity is pronounced. Expenditure patterns on items affected by water salinity include obvious factors such as the socio-economic context, fashion, climate, geology and the local environment. Isolating the effect of salinity on household behaviour is possible only to a limited extent. It will not always be possible to separate the effects of variables such as climate or susceptibility to advertising from the effects ascribable purely to salinity.

Ideally the costs of salinity would be derived from comparing the expenditure and behaviour of similar households in areas of differing salinity. However the above-mentioned factors preclude making such comparisons with any degree of certainty. The "noise" from these other factors will invariably drown the marginal effect of increased salinity. The inability to control for all these factors (and thus reduce the "noise") would result in attributing extraneous factors to salinity (or vice versa).

The attribution of costs to the effect of increased salinity in isolation from compounding factors such as lifestyle, climate, environment, and whimsical preference, is challenging. No study design would provide an entirely satisfactory solution to this dilemma. Perhaps the most helpful study in this regard was a large postal survey conducted in the USA in 1972 by Metcalf and Eddy (The economic value of water quality). By surveying over 30 communities with experiences across the range of water salinity they were able to deduce trends that transcended local conditions, fashions etc. As only a few major demographic variables were reviewed (household size *etc.*) this type of analysis is of limited value for

extrapolation to particular localities. Without the opportunity to conduct a similar large-scale survey in South Africa it is necessary to design a study in such a way that households would reveal valuable information without the *ceteris paribus* assumption. Moreover the study design should be able to measure the additional costs associated with salinity, even though these costs may be small, overshadowed by existing consumption patterns, and residents may be oblivious of the costs.

3.2. METHODOLOGICAL OPTIONS

Proven methodologies for making the required estimates under the indicated conditions are, to put it mildly, rare. The marginal and oblique nature of the cost impact of increased salinity indicates that neither trend nor comparative analysis of household expenditure will shed much light on the cost impact of salinity in any particular situation. In the absence of these instruments, technical models have been adopted as an accessible and affordable next best option. Inevitably these models tend to be unable to relate expected to actual behaviour - allowing for a great deal of uncertainty regarding cost estimations.

Of particular note here is the consistent failure of the technical approaches to include all the items which contribute significantly to the total cost incurred. The architects of the technical approaches tend to confine their observations to fields with which they are familiar - being oblivious of other factors or dismissing other factors as extraneous or insignificant. As a result calculations often have to be premised with statements like:

> *Items not included (in the costing) are: costs of detergents, costs or benefits of potential health effects, costs of increased lawn and shrub care, swimming pool maintenance, bottled water purchases and others*
>
> US Department of the Interior, 1980.

These "others" would, more often than not, include vehicle repair or maintenance or health and beauty products. The items excluded constitute a substantial proportion (if not most) of the actual costs incurred by households in some socio-economic groups.

3.3. OVERVIEW OF METHODOLOGY

Central to most surveys is the assumption that the respondent has the cognitive ability and inclination to answer questions faithfully. More often than not it is simply assumed that respondents are so equipped and there is negligible consideration of the role of mistake, misrepresentation and ignorance. All too infrequently the underlying assumptions in survey construction are examined.

While acknowledging that some interview techniques yield better responses than others, it must also be acknowledged that some respondents are better equipped or more willing or able to respond than others. Concentrating resources on interviewing such respondents inevitably presents a dilemma in having to trade better-informed responses off against representativity.

This particular study rose from an attempt to estimate the cost to households of increased water salinity. It is thought that the method employed may form the basis for discussion of the role of surveys in which the responses of a sub-sector of the universe yields more informative data than responses from a representative sample. Opportunities to use any method exploiting non-representative samples abound - ranging from interviews on sensitive subjects (e.g. sex) to ones in which few will offer candid responses (crime, "deviant" behaviour) and to situations (as in this salinity survey) in which the respondent in oblivious to anomalous conditions and thus consider their behaviour to be normative.

3.3.1. Salinity survey

Increased water salinity affects household behaviour in many ways. Some effects are subtle and other more marked, nevertheless it almost invariably reflects a cost to households that has to be weighed

against the cost of desalinating the water supply. The accurate calculation of the cost to households of increased salinity is one on which considerable investments may rest. Despite the imperative to accurately calculate the costs, such estimates have eluded engineers and social scientists alike.

Precisely how households react to increased water salinity is dependent on a variety of factors including climate, fashion, wealth, culture, access to services and so on. Moreover, the increases in question result, essentially, in marginal changes in household consumption patterns and behaviour patterns. These usually include increased consumption of detergents and bleaches, changes in the use of health care products, adaptations to the way in which fabrics, household utensils, appliances and other assets are maintained and to changes to the rate at which they are devalued. These impacts are essentially marginal - a change in the rate of consumption or devaluation over and above the existing the rate.

Estimating the impact is further complicated by the fact that residents acclimatise to the condition of their water. The water quality does not vary on a day-to-day basis and is consistent with that in neighbouring areas. Residents adapt their behaviour to the water and eventually come to accept their behaviour as "normal" - it is largely consistent with that of their neighbours and with their own behaviour of some time ago.

The complications arise from a combination of factors that makes it impossible to reliably differentiate the changes in behaviour induced by salinity and those dictated by climate, marketing or other factors. The inability to differentiate between causes in behavioural changes precludes comparative studies. Short of increasing the salt content of the water in a community and observing their behavioural changes, it is not possible to find communities so similar in all regards except water salinity that the differences can be attributed solely to increased salinity. The complex milieu into which water salinity enters highlights one of the limitations of surveys - the probable false ascription of changes to the topic of study rather than to other (more pertinent but unprompted) factors.

3.3.2. Methodological response

The problem presented above may appear parochial but it contains the essence of a problem frequently confronting social researchers. How do you measure the impact of a factor to which respondents are oblivious, ignorant or reserved? In the example respondents have internalised their behaviour as "normative" and are thus not in a position to speak as to what their behaviour would be if the world was different.

The difficulties associated with this type of research have forced almost all previous salinity research into a "technicist" paradigm. These paradigms assume idealised patterns of behaviour. Such assumptions may include those of "economic rationality" or "optimal technical performance". Actual behaviour rarely, if ever, coincides with such assumptions. The technicist approaches nevertheless offer benchmarks against which alternative results can be measured and evaluated. In this regard alternative results were derived from a "non-representative" survey.

In so far as the impact of increased water salinity is concerned, one group of residents is able to speak with both clarity and reflection - newcomers to the high salinity area. Without having become acclimatised to the water these residents tend to be acutely aware of the impact of water salinity. They also tend to be able to distinguish between the changes in their behaviour attributable to water salinity and those attributable to fashion, economics etc.

Herein rests the dilemma. Those who can speak authoritatively as to the impact of the water salinity do not (virtually by definition) represent the wider community. They do not, as yet, share the habits and customs of the wider community they are probably experiencing the throes of the economic and social advantages (and disadvantages) of relocation. Moreover they are, if anything, hyper-sensitive to anomalies like water salinity. What, if anything, does an examination of the behaviour of newcomers reveal about the behaviour of established residents?

3.3.3. Towards a solution

The observation of newcomer behaviour will primarily reveal the parameters of the behavioural changes brought on by increased salinity. It reveals where the impact of increased salinity lies, what behavioural adaptations are made, the nature, and cost (financial and behavioural) of these adaptations. In short it will provide the broad brush strokes describing the adaptations and the limits of those adaptations. These brush strokes may enable the researcher to subsequently identify which behavioural responses may become permanent - those that ultimately become "internalised".

The fact that some responses are not uniformly consistent with time indicates that these brush strokes tend to describe the outer parameters of changes. In this instance the time trend reflects that it takes time to learn optimal responses to increased salinity. Behavioural changes tend to be less efficient in initial stages. As households learn more effective and efficient responses, the costs incurred are reduced. The parameters reflected by observing the newcomers' behaviour thus require moderation if they are not to be period specific. Estimates of the moderation may be derived from an examination of trends in newcomers' behaviour and with the behaviour of established residents. The behaviour of established residents can, because of the context indicated above, offer little more than an imperfect description of the minimum boundaries of changes.

It was assumed that germane to the behaviour of newcomers are descriptions of the practices and habits of the established residents. It was also accepted that the behavioural parameters as described by newcomers' responses should and could be moderated by an examination of time trends and the behaviour of established residents. (Greater discomfort is experienced when attempts are made to extrapolate the moderated survey results to the population as a whole - particularly when it comes to quantifying the confidence intervals.)

There is a compulsion to survey as many newcomers as practical to ensure that the full ambit of behaviour adaptations are captured. When the costs of those adaptations are quantified, greater sample sizes increase reliability and reduce the variance in responses. In the case study, adequate numbers of newcomer households were difficult to identify- particularly when given the proviso that these households must exhibit social and economic continuity in household structure. However, no matter how large a sample of newcomers are captured, they can not be considered as representative of the established community.

To move towards an estimate of the total cost (towards a generalisation) it is necessary to establish the nature of the non-representativity. In so far as social, cultural and economic factors are concerned it can be accepted *prima facie* that the newcomers do not represent the established community in any significant way. The questions of representativity can be substantially narrowed, as the impact of increased salinity is the only concern. Increased salinity impacts on a number of arenas can be defined fairly comprehensively (surveys of established residents and technicist models and from the newcomers surveys). The ability to define the nature and scope of impacts allows the question of representativity to be narrowed to a series of inquiries like:

> *"do newcomers' behaviour with regard to the laundering of fabrics differ from that of established residents?"*

Similar questions need to be asked for every item in the series of queries regarding behaviour and possible behaviour adaptations.

The solution is to precisely define the nature of representativity in each instance and thereafter draw deductions. Instead of making blanket statements of representativity (or lack thereafter) a comparative study of the behaviour of newcomers and established residents must allow the question to be answered in every specific instance. In conjunction with the trend analysis, such analysis also allows for deductions as to the ability to extrapolate the costs to the population as a whole. This is the essence of the moderation of the newcomers survey results.

The method, however, begs the question as to how any behaviour can be considered representative if it stems from an unrepresentative sample? Ultimately that question has to be answered through a congruence of behaviour between newcomers and established residents in that specific regard. This may put a particular spin on the notion of "representativity" in that it is opportunistically defined as being representative when it has (*post hoc*) been demonstrated to be typical of or congruent with what want to be represented.

The problem, as originally described, is that the established residents (those against which congruency needs to be demonstrated) may not know their own minds and are unable to adequately ascribe behaviour to salinity rather than to other effects. Congruency thus has to be inferred from consumption patterns and from direct queries regarding behaviour.

3.3.4. Methodology adopted

For this study a novel approach was thus required. An attempt was made to address the methodological difficulties while escaping the constraints imposed by technical assumptions. This tack was dependent on interviewing newcomers to high-salinity areas about their behaviour adaptations. This methodology entailed something akin to "tracking" in that observations were recorded of behavioural patterns, as households grew accustomed to new conditions. This methodology rests on newcomers' ability to indicate their behavioural adjustments on being confronted with increased salinity. Such households would have to fulfil a number of criteria.

Thousands will have to have arrived in the high-salinity area from a low-salinity area recently enough to be able to recount and quantify the differences in their behaviour. Preliminary indications were that most of the movement of households in the survey area was from elsewhere in the salinity zone. Most newcomers to the area would thus have to be excluded from the survey for this reason.

The economic, social and demographic profile of the households would have to be maintained across the move. Traumatic events related to changes in household income, size and status would render the tracking pointless as the "noise" would again be indistinguishable from the impact of salinity. The number of households eligible from (1) above would thus have to be reduced again to exclude those households in which the social, economic and demographic profile of the household had not been maintained.

If it proved possible to identify an adequate number of households that met both the above selection criteria and the residents were willing to take part in the study, then a survey could be conducted to see what adaptations the "average" household (in that socio-economic and service group) underwent to accommodate the increased salinity.

The small number of households that would meet the selection criteria (and the fact that they could not be considered representative of the wider community) forces the study to rely on two assumptions, namely behavioural representativeness and consistency.

3.3.4.1. Behavioural representativeness

Households from similar socio-economic strata react to increased salinity in similar ways. It can be assumed, for example, that middle-class suburban households with access to similar services react (broadly) in the same way as their neighbours to the decreased ability of detergents to lather. The assumption makes it possible to measure the cost of increased salinity in all its forms and allow for generalisations regarding *behaviour*.

3.3.4.2. Consistency

The second assumption is that behaviour adjustments made by newcomer households have already been made by households acclimatised to local water conditions. This assumption allows for some

behaviour patterns to be generalised from the newcomers to the established residents. The validity of this assumption can only be accepted once the changes made by newcomer households are identified and compared to the behaviour of acclimatised residents.

3.3.5. Background and Scope

To explore the correlation between the behaviour of newcomers and established households, a survey had to be conducted amongst established residents too. This survey would have the following two objectives:

- It should serve to identify the reasonableness of the assumption of consistency on a range of behavioural adjustments. By asking acclimatised residents how they have adapted to the water salinity, some comparisons in behaviour could be made. Such comparisons would be subject to the understanding that established residents would underestimate the impact of salinity or even be oblivious to its effects. Nevertheless the supplementary survey would afford an opportunity to examine the reasonableness of extrapolating the behaviour changes of the newcomers.

- In the study newcomer households are not considered representative of the general population, particularly in so far as their income, demographic and service profiles are concerned. The assumptions indicated above affect only some of their behaviour adaptations. To extrapolate the behaviour patterns it is necessary to develop a representative profile of the wider population reflecting household composition, income and expenditure, while indicating the pervasive use of water-related appliances in each socio-economic category.

The second survey would thus also be the basis for the extrapolation of behavioural changes. While this survey is required to be representative, the behavioural survey (the "tracking" survey) would necessarily encompass as many households from each socio-economic category as possible but would not be considered representative of the wider population, mainly because of the selection criteria and the sample size for the "tracking" survey.

3.3.5.1. The selection criteria

The selection on the basis of recent arrival in the high-salinity region is reason enough to indicate the non-representativeness of the sample. However, it is here where the central conundrum is manifest - the more representative the sample, the less helpful the information. Newcomers have to be selected as they will be aware of their behavioural changes. The longer households have been living in the area the more oblivious will they be to their responses. However, it is only these longer term residents who could be considered representative of the larger population.

The sample sizes for the "tracking" survey would inevitably be small. The most immediate impact of this would be in the variability of the results. Particularly where expensive capital items (like motor vehicles) are concerned the range of costs incurred would be great. This could make different samples yield significantly different results. As will become clear this factor is of greater concern with respect to capital items than it is in regard to consumer goods. It would therefore be appropriate, where possible, to verify findings against secondary sources. Fortunately preliminary studies revealed at least one instance in which the cost impact on a capital item (electric geysers) could be verified against other (non-technicist) methods.

The most important implication of the non-representativeness is that attempts to quantify the reliability of the data will remain questionable. This is not only a function of small sample size, because increasing the sample size of the behavioural survey does not overcome the limitations in making generalisations.

The results are derived from a series of surveys conducted in the Vaal River catchment area - a region typified by noticeably saline water. The surveys were conducted in the urban districts of the Welkom region in November of 1995 and in the urban districts of Klerksdorp in early 1996. The results from the

initial Welkom survey were deemed inadequate for the purposes of extrapolation to the wider Vaal catchment area for a number of reasons, but primarily because the district is in a phase of marked economic decline which is atypical of the region as a whole. This decline fundamentally influenced the way in which households react to increased water salinity in terms of both the costs they were prepared to carry and the investments they were prepared to make. Moreover the Klerksdorp surveys were used to supplement these findings and allow for the identification of behavioural trends that could be deemed representative of general behaviour that transcended location.

Apart from the above-mentioned aims in respect of the Klerksdorp surveys the studies had the same objectives:

> 'to determine if and how household behaviour is modified in response to increased water salinity and, subsequently, to determine whether, and to what extent, households incurred additional financial costs as a result of increased water salinity."

The methodology employed in the studies are similar in essential features, allowing for the identification of similarities and divergence between the regions and the identification of universal patterns that can be unambiguously attributed to the increased salinity. Trends identified as similar in communities that are climatically, geographically, economically and socially diverse could be attributed to the effect of salinity with a much greater degree of certainty and validity. The triangulation of the three studies (one in Welkom and two in Klerksdorp) allows for the unambiguously attribute patterns to a specific cause. Consistent behavioural adaptations could thus be generalised. Within certain limits it is possible to extrapolate the findings to the wider community.

This methodology poses several advantages such as the qualitative analyses of the in-depth interviews in Welkom and the Klerksdorp area leading to the identification of behavioural and consumption trends which can be compared with the data generated in the probability sample drawn in the Klerksdorp area. This comparison allows for the identification of the limits to extrapolating newcomers' behaviour as typical of adjustments already made by established residents.

By combining different lines of enquiry a "holistic" view of the study questions is possible, this would deepen and detail an understanding of the interface of household behaviour and increased water salinity.

The analyses (inductive qualitative and descriptive statistical) are mutually reinforcing and illuminating. This strengthens the relevance and credibility of the research findings because, inevitably, conclusions based solely on non-statistical analyses carry less weight or are less credible than conclusions based on multiple lines of evidence and analysis. The approach allows for the assessment and comparison of competing hypotheses.

3.3.5.2. "Political" considerations

If increased salinity affects household behaviour and budgets, then the effect would have to be captured globally. In other words, if the effects are significantly different on economically and socially marginalised households (such as the informally housed sector of society) than on the more affluent households, the study would have to capture and explain the trends. These trends will furthermore have to be understood in the context of the politicisation of many of the "inputs" like water provision, electrification, etc.

While acknowledging that the politicised nature of such related issues will introduce a degree of response bias it is unlikely to significantly affect the validity of findings and conclusions. The politicisation of service provision would be of greatest pertinence in informal settlements, but would also affect the formally housed sector in townships and suburbs. Another, perhaps potentially more damaging, source of response bias could be the act of asking questions regarding the impact of salinity. Such questions would inevitably induce sensitivity to the issue among some respondents. For example,

the high incidence of residents of informal settlements characterising the water as tasting "salty" is evidence of response bias. Were it not that other objective data confirms a "salinity effect", these data would be of limited value in gaining an understanding of how these families experience water with increased salinity.

3.4 CONCLUSION

On account of the behavioural nature of the household sector's reaction increased salinity, an unique surveying methodology had to be adopted. This referred to quantitative and qualitative surveys to adequately compare responses to identify and isolate behaviour solely attributable to salinity. The case study conducted in the study area following the methodology is discussed in the next section.

4. CASE STUDY

4.1. INTRODUCTION

The purpose of this section is to discuss the surveys conducted in the Middle Vaal River as a case study to verify the hypothetical formulation. The reason for conducting surveys is to obtain information on the effect of salinity on households. The results of the surveys have been analysed and transformed to be used in the integrated model for costing the total impact of salinity.

4.2 STUDY AREA

The area identified for the case study refers to the Middle Vaal River Area which stretches from the Barrage to the Bloemhof Dam. The following magisterial districts are included:

- Klerksdorp (Orkney, Stilfontein)
- Odendaalsrus (Allanridge)
- Virginia
- Welkom
- Bothaville
- Hennenman
- Ventersburg
- Parys
- Viljoenskrron
- Wesselsbron
- Theunissen.

In order to extrapolate from average household costs encountered in the sample area (Klerksdorp and Welkom) to total regional cost a reliable estimate of existing population in suburban, township, informal and hostel sectors is required. The estimates used below have been derived from the NELF database (1992 estimates) and from the 1991 census (hostel component only). The catchment area. has been defined by the hostels, towns and townships in magisterial districts as listed above. The figures exclude households in the rural areas as they are not served by the water reticulation system.

Sector	Households
Suburban households	59 270
Informal households	30 070
Township households	63 952
Hostels	253 434 individuals
Equivalent	*42 882 township households*
Total households	196 174

4.3. STUDY DESIGN

The best chance of identifying adaptive behaviour in response to increased salinity lies in capturing information from households that have recently moved into a high-salinity area from a low-salinity area. Both "qualitative" surveys were thus predicated on making use of a "window of opportunity". Understanding how the behaviour of such "newcomer" households change in response to increased salinity would afford the opportunity to estimate the costs to households. Using the trend data from both "newcomer" surveys, it is possible able to develop a typology (model) to characterise the adaptive behaviour and associated costs. This model can then be tested against the data generated from the comparable statistically representative probability sample surveyed in the Klerksdorp area, which is primarily used to provide typical household profiles for the three sampling categories.

The sampling categories were selected on the basis of access to services. Such access broadly conforms to housing type and, in turn, to economic status.

The three categories selected were thus:

* **Suburban households**: These households are typified by access to full services (and the ability to maintain and use such services) including in-house plumbing and continuous electricity supply. These households would invariably be housed in formal structures. The average monthly expenditure of these households was R3 633.

* **Township households**: The households are typified by less privileged access to services (partly as a result of reduced ability to pay). Although these dwellings were also of formal construct they would not necessarily enjoy indoor plumbing or a continuous electricity supply. At R1 439 the average monthly household expenditure is less than half that of suburban households although township households tend to have more members.

* **Informal households:** In the region under examination these households tended to form a geographically distinct entity. They would be typified by their informal structure and the lack of indoor plumbing. Many however enjoyed access to electricity consumed on a "pay first" basis. The average monthly household expenditure of these households is R832.

This stratification informed the sampling of both the quantitative and the newcomer surveys.

4.3.1. Newcomer/qualitative Sample

Criteria for selection for the qualitative newcomer surveys were as follows:

* Households interviewed would have to have moved to the high-salinity area from a noticeably low-salinity area. Preferably the move would have occurred not less than four calendar months before the interview and no longer than two years before the interview. This narrow time margin is necessary for respondents to be able to remember and contrast their pre-move behaviour with the behaviour in the high-salinity area. The margin also allowed for sufficient time to adjust to the impact of increased salinity. (Note: Due to problems encountered in the recruiting of respondents who fit the narrow time criteria, the "window" was extended by up to seven months for a few respondents, but only after the researchers were satisfied that the respondents in question were indeed able to remember and contrast pre-move behaviour in a meaningful way.)

* Only adults who proved familiar with household expenditure patterns and income were interviewed.

In both the Welkom and Klerksdorp districts the sampling was stratified as follows:

- households from suburban areas
- households from formal housing in townships in each district
- households from informal settlements (shack areas) in each district.

Where possible, interviews were conducted in the mother tongue of respondents. Interviews were thus conducted in English, Sesotho, Sepedi, seTswana, Zulu, Xhosa and Afrikaans. The interview schedule allowed for the capture of quantifiable data as well as depth and specificity regarding perceptions and behavioural adaptation associated with increased salinity.

4.3.2. Quantitative sample

As far as possible the instrument for the probability quantitative survey of Klerksdorp-Orkney-Stilfontein residents was kept directly comparable with the interview schedule for the newcomer surveys. This instrument, while allowing for the capture of some qualitative data, was primarily intended to provide a

quantitative description of the income, expenditure and demographic and service profile of the study area. Conclusions and extrapolations drawn from these data, within set parameters, complied with the rules of scientific reliability and validity.

A sample of 348 households was drawn from randomly selected enumerator areas in the Klerksdorp-Orkney-Stilfontein region. In each of these enumerator areas a cluster of four households were selected. The final breakdown of households interviewed was as follows:

- Suburban 137
- Township 128
- Informal 83
  Total 348

Most hostel dwellers in the region are housed by the mining industry which, as an industry, covers most of their living expenses. As the bulk of increased costs are borne by the industry hostel dwellers (as a distinct socio-economic group) were excluded from the household survey. In the interests of comprehensiveness it was necessary to include these "households" as part of the household component. As they were not part of the original survey they have been treated using a proxy measure - the equivalent of the *per capita* costs incurred by township households. The justification for using this base rather than the informal households lies in the range of services to which they have access and their income levels. Hostel dwellers generally (and particularly in the mine hostels) have access to a high level of services normally associated with formal housing (indoor piped water, electricity etc.). Although hostel residents tend to be migrant labourers and remit large proportions of their earning elsewhere they do enjoy high income levels. The high income levels is primarily a reflection of the low levels of unemployment among hostel residents. In the mining industry accommodation in hostels is assured only by being employed by that mine.

4.4. SURVEY METHODOLOGY

The method employed in the case study is sumarrised:

- The stratification of the target area (high salinity district) into broad socio-economic strata reflecting ease of access to services (like electricity, water) and resources (finances household appliances).

- Identification of newcomers to each the strata in the target region. Newcomers were afforded a lead time of three months to adapt to the local conditions but were expected to still be sensitive to the adaptations they made to local conditions. Newcomers were thus defined as those who had been in the area for between three and twelve months. (the latter limit was determined by force of circumstances). They were, furthermore, to have in-migrated from an area of noticeably lower water salinity and would have to have maintained their household structure across the migration without experiencing traumatic economic disjuncture. **A minimum of twenty households were required for each strata.** This number was determined more by the difficulty in accessing larger numbers than any statistical criteria.

- These households were then interviewed to gain details of how they perceived local water conditions, how they reacted to the same and what the cost impact was in terms of time, effort and finances. Central to this was obtaining expenditure profiles of salinity-affected items and consumables before and after the migration. Households were asked to estimate the extent to which the change in the consumption profile was attributed solely to increased salinity. Profiles regarding household composition, access to service and appliances, and economic resources were collected at the same time.

- A representative random sample of each of the strata was identified and interviewed. The purpose of this survey was twofold. Firstly, it allowed for the creation of a demographic, economic, services, and appliance profile of each of the strata. This data was not available form other sources and would be the basis for the extrapolation of total cost. The second objective was to test to see to

what extent the adaptations implied by the newcomers were evident in the behaviour of established residents. This was done through the acquisition of detailed consumption patterns of all items (capital durable and consumable) affected by water salinity and through directed questions aimed at determining continuity in behaviour. It was not possible to obtain from this sector the costs attributable solely to salinity.

- The newcomer survey was examined to isolate (and measure) adaptations unambiguously attributable to increased water salinity. This process established the broad parameters of household behavioural adaptations - which required moderation. The moderation was affected by comparing their behaviour with that of the established households to identify which patterns were maintained, and to what extent they were maintained. Obviously these comparisons and estimations required the normalisation of the data to take into account access to services, appliances, economic resources and household size. The comparison indicated two types of congruence in the different surveys.

- The behaviour patterns of newcomers were reflected by the established households (increased use of bleaches etc.) in a way not requiring substantial qualification or moderation. In these instances the cost implications (as inferred by the newcomer behaviour) was moderated and then used for extrapolation.

  The behavioural adaptations of newcomers were not reflected by the established households (increased consumption of carbonated drinks). In these instances the adaptations were ignored as they appeared to be reactions which ameliorated over time to such an extent they disappeared with a few years.

  Those responses that were not fully maintained by established households presented the greatest difficulty as it indicated an initial over-reaction by newcomer households that was to partly diminish with time. Although the newcomer survey could indicate the upper limit of the effect the survey of established residents was unable to adequately indicate the lower limit. In these circumstances careful consideration of the evidence in each instance allowed for calculation of the extent of moderation. This process was only possible as adequate information reflecting the rationale of changing consumption patterns at the interview stage.

- The moderated information was used to impute the increased cost for every item affected by water salinity. These costs were then used to estimate the cost to the community (as opposed to the household) of increased salinity. The extrapolations were based on the representative sample which indicated the "penetration" (or degree of use) of individual capital items (hot water geysers etc.), durable items (steam irons etc.) and consumables (detergents etc.). The household costs were then weighed against penetration rates to obtain the cost to the community. This total cost thus took into account access to appliances and services in the context of their use in that environment.

4.5 CONCLUSION

The greatest problem with the method lies in its inability to present an estimate of sample error. Estimates of variance in responses can be made and can indeed be refined through a number of instruments including *monte carlo* simulations, Delphi models and a range of models based on cruder assumptions. The latter include the technicists models which have, in this study, served as a benchmark against which the methods may be evaluated. None of these methods can indicate the error attributable to sample size - an unrepresentative sample can not be deemed to be representative. The adequacy of the size of the sample thus needs to be as large as possible but however large it is it can never be considered "representative" of the wider community. In effect with an assumption of the "twisted" representativity and the need to minimise the variance in those responses provided the solution to the sampling problems. This section was used to report on the survey methodology used as well as some salient issues observed during the interviews. The next section is used to quantify the survey results.

5. QUANTIFICATION OF COSTS

5.1. INTRODUCTION

The analysis of the behavioural adaptations of newcomer households reveals a range of actions which could be attributed to increased salinity. Those adaptations were often associated with an increase in household expenditure after their move. Household expenditure before and after the move was scrutinised to eliminate elements that could not be attributed solely to increased salinity. Following the normalisation of these costs and their aggregation (based on how widespread the use of the affected item in each sample category was) a benchmark cost estimate was derived item by item.

5.2. QUALITATIVE ANALYSIS: SURVEY OF NEWCOMERS

Perhaps the most striking and cogent feature of the Klerksdorp-area newcomer qualitative survey is the degree to which the trends and patterns identified in the Welkom study are mirrored and confirmed. The fact that households report similar adaptations to higher salinity levels in two geographically, socially, climatically and economically distinct and diverse regions is of particular salience, in that it verifies two important aspects of the reported behaviour: i) that the adaptive trends are "real", and ii) that the phenomena which are not bound by specific environmental factors can be identified. It is thus now possible to make categorical statements regarding the effects of increased salinity on household behaviour and budgets.

Increased salinity is associated with behavioural adjustments and specific costs to households. These patterns transcend social, economic and cultural divisions. The costs incurred go beyond expenditure on consumable, durable or capital goods. Household responses to increased salinity also involve social costs, such as increased time and effort spent on maintenance and repair of goods damaged or affected by mineral deposits. Additional effort and energy are also expended on cleaning activities such as scrubbing tiles, descaling utensils, washing cars, lamps and windows. Some costs are hidden when householders opt not to replace damaged items, thus forgoing conveniences and technologies to which they had become accustomed before the move to the high-salinity area.

5.2.1. Perceived impact on health

When adjusting to water with higher salinity content than hitherto experienced, householders are prone to making assumptions regarding the health and potability of water with increased salinity. Many of the perceptions which are prompted by discernible differences in taste and odour have no basis in fact. A widely held perception is that the water in the Welkom and Klerksdorp areas contains substances which place human health at risk. This perception is not limited to a particular sector of society, but is pronounced regardless of socio-economic or cultural background. Most families interviewed in the Klerksdorp and Welkom areas applied remedies to "improve" the water. The most commonly reported practice was the boiling of all drinking water. This widespread practice seems ironic and counterintuitive because when water with a high-salinity content is heated, the overt attributes of the mineral content are, in fact, intensified rather than ameliorated. Several of the reported responses tend to aggravate the saline content. Other reported effects were incorrectly attributed to salinity, nevertheless they were perceived by respondents to be a product of the water salinity.

A full range of practices intended to ameliorate the effects of increased salinity, of which boiling is but one, is employed by households adjusting to the water quality. The "remedies" applied tend to vary according to economic status.

The practices range from the simplistic, letting the tap run for a while so that the water clears, or letting the water stand for a while to clear, to the purchase and use of water purifying systems. In order of incidence, the "water enhancing" behaviour is as follows:

Boiling of water intended for drinking.

- Chilling of water intended for drinking. (In the informal settlements households purchase ice cubes for the express purpose of chilling drinking water.)
- Letting water stand to clear before use.
- Adding "purifying" substances such as chlorine bleach. (These substances are often added to both drinking and cooking water.)
- Use of water filtration devices.
- Adding lemon juice or vinegar to drinking water.
- Adding a small amount of sea water to all water used for household purposes. The use of sea water in this way seems culturally bound and was attributed by one respondent to its prophylactic, curative and purifying effects.

Without exception the respondents in the Klerksdorp and Welkom areas noted the discernible difference in taste as an overt attribute of increased salinity. As mentioned, it is likely that the high incidence of characterising the taste as "salty", especially for households that reside in informal settlements or townships, may be partly attributable to response bias. However, when the characterisation is controlled with the reported ameliorating behaviour, it is clear that respondents do discern a difference in taste, and further, that their perception of this difference induces behaviour responses.

A very marked trend is for households to change their water-drinking habits, either by avoiding the drinking of unadulterated water, or by adding substances to enhance the taste. An increase in the consumption of carbonated beverages, fruit juices and beer is characteristic of the newcomer surveys in both the Welkom and Klerksdorp areas. Several households also reported an increase in the consumption of tea and coffee - citing the unpalatability of the water as the reason for the increase. Concomitantly, households reported a gradual adaptation to the taste of the water.

A very pronounced trend in both the Welkom and Klerksdorp areas is the view that increased salinity in the water contributes to dry and itchy skin. In conjunction with this trend noted, a substantial increase in the use of lotions and emollients was evident.

Many newcomers reported that their hair was dry or falling out. Affected respondents strongly associated the deterioration of their hair condition with the increased salinity. Again, this trend induces adaptive behaviour. A marked increase in the use of hair conditioners and treatments was noted. Many township and shack dwellers opted to abandon home care for hair, preferring to incur the additional expense of regular salon treatments.

The drying and deterioration of skin and hair were commonly noted effects associated with increased salinity, but various other conditions were also attributed to salinity.

The following conditions (in order of incidence) were reported and associated with increased salinity by newcomer households in the Klerksdorp and Welkom areas:

- diarrhoea
- constipation
- dandruff
- digestive complaints
- nappy rash
- darkening of skin
- lightening of skin
- kidney stones
- boils
- eczema
- tonsillitis
- fits
- tooth ache.

While it is clear that some of the perceived effects of increased salinity have no basis in fact, the perceptions are nonetheless of analytic importance in that they point to a tendency of attributing non-

potability and unhealthfulness to overt signs (taste, appearance) of increased salinity. Seen in the context that "reality as perceived has real consequences", this phenomenon raises concern. Several respondents indicated that their fears regarding the potability of the water led them to add various substances (chlorine, bleach, dip, Jeyes Pine, Dettol, sea water, vinegar, lemon juice) to drinking and cooking water. It is patent that some households might be introducing harmful substances to the family diet in the mistaken belief that water with increased salinity, if left untreated, is not potable.

5.2.2. Laundry and ablutions

The second most noted overt characteristic of water with high-salinity reported by newcomers to both the Klerksdorp and Welkom areas was an unpleasant odour associated with the water. This odour was variously described as metallic, rotten, sulphurous, stale, salty, muddy or chlorine-like.

Furthermore, the appearance of the water in both the Welkom and Klerksdorp areas was variously described as chalky, muddy, milky, yellow, filled with sediment, dirty or having granules or chunks of solid materials. Both the odour and appearance noted by householders are strongly associated with increased salinity of the water.

Most newcomers reported the reduced foaming of their usual brands of soaps, detergents and shampoos when used in water with higher salinity. This characteristic of the water is strongly associated with adaptive consumer behaviour. Not only is there a marked trend towards the increased use of these products, but there is also an escalation to brands which are more concentrated (detergents and cleaners) and which contain emollients (soaps and shampoos). This trend is present, regardless of socio-economic or cultural characteristics.

A substantial increase in the use of bleaches and fabric softeners was also reported. Chlorine bleach is commonly used as a descalant, to clean mineral deposits from utensils and appliances, and to whiten laundry. Several families reported adding bleach to household water as a purifier. The increased consumption of fabric softeners was predominantly attributed to the "hardness" of the water.

Respondents to the newcomer surveys in both study areas were particularly sensitised to the fact that the additional salinity in the water caused them to labour longer and harder at routine cleaning tasks. Common complaints were about the difficulty involved in cleaning windows and glassware without mineral deposits leaving streaks. Many households attributed indelible stains in toilets, bath tubs and on tiles to increased water salinity. Almost without exception, households reported difficulties in descaling pots and utensils.

Several households mentioned that a relatively simple task, such as washing a car or the mantle of a paraffin lamp, was more difficult in the high-salinity area because of the additional drying and wiping required to get rid of stains caused by mineral deposits.

5.2.3. The impact on durable goods

Regardless of socio-economic position, all households make behavioural adaptations due to the increased salinity. The major difference between the formally housed and the informally housed, is the extent of their investment in housing and durable goods. The costs associated with increased salinity for the informally housed are manifest mainly in increased use of consumer goods such as cold drinks, detergents, fabric softeners, bleach, lotions and emollients. When the average household income of marginalised shack dwellers (R837 per month in the Klerksdorp area) is taken into account, it is patent that **any** additional costs to these families are hard to bear.

The formally housed residents of townships and suburbs, by virtue of their ability to invest in durable and capital goods, incur maintenance and replacement costs which are directly attributable to the higher salinity. It is striking that households report incurring additional replacement and maintenance costs very soon after establishing themselves in the high-salinity area. They claim that when a chemical descalant

(or the appropriate amount of effort in manual cleaning) is not regularly applied, the life of electric kettles is reduced from years to months. On average, households in high-salinity areas claim to replace kettles twice per year.

The second most frequently reported appliance adversely affected by increased salinity is the electric steam iron. Mineral deposits clog the holes for steam emission. Households report rigorous maintenance activities as well as a high incidence of replacement of steam irons. A fairly common pattern is to use the steam iron as an ordinary iron after the steaming mechanism has broken down.

The tendency to forgo certain technologies due to problems associated with increased salinity is quite pronounced and is manifest irrespective of relative wealth of the households concerned. For example, in township households, the repair or replacement of expensive items such as hot water geysers is often postponed until the family could better afford it. The result is that households do without hot water for extended periods.

Householders reported extensive replacement and repair of taps, shower heads, pipes, toilet and geyser valves, geysers and water sprinkler systems. Several households reported the suspicion that they were replacing car batteries more frequently than before moving to the high-salinity area. There is some evidence that car radiators and cylinder heads or gaskets demand more than usual replacement and/or maintenance in high-salinity regions. Pool owners also report a high incidence of maintenance and/or replacement of filters and pool-sweeping devices. The costs incurred for maintaining and replacing these items tend to be high.

5.3. EFFECT ON HOUSEHOLD BUDGETS

The behavioural responses to increased salinity do have associated costs. However, isolating those costs which can be unambiguously attributed to the effect of increased salinity is challenging. The analysis of the costs to households is conservative and the actual costs to households are possibly understated. This is due to the fact that such consumer items which may be influenced by other factors - even though respondents may have associated these with increased water salinity - have been removed from the accounting. A salient example of this is the trend to increased consumption of beverages other than tap water. The potability of the water drives residents to increase their consumption of water flavourants. However, the form which this takes - drinking carbonated colddrinks and alcoholic beverages - is also a reflection of media and social pressure confronting newcomers. Although the consumption of these drinks is a substantial proportion of the total cost (initially) incurred by newcomers, it does seem to taper off with time. As the increased consumption of these beverages can not be unambiguously and consistently ascribed to water salinity, this cost element has been excluded from the estimates.

The validity of the results presented is dependent on the extrapolation from a non-representative sample to the universe. (The sample for these cost estimates were based on a non-representative sample of a "rare event" - households who had recently moved from a "normal" salinity area to the high-salinity area.) The behaviour modifications in these households have, in accordance with the assumptions set out at the beginning of this report, been treated as if they reflect the behaviour modifications in households that have already adapted to the water.

The sample thus does not need to be representative of household size, income *et cetera,* but rather representative of the general categories through which behavioural adaptations can be described. The sample was thus stratified by housing type as they represent, broadly, income categories, levels of service received and standards of living - the most blatant determinants of behaviour in this regard. The responses which indicate behavioural adaptations are then examined for generalisability, relevance and reasonableness. To facilitate the latter, the cost equivalents of adjustments are presented. Once outliers and "quirks" are removed the findings are treated as typical of the general category.

Several points need to be noted:

- Extrapolation of results are limited to behavioural aspects and are not used for representativeness of non-behaviour features. For the latter a representative quantitative survey is used.

- The effects of salinity are only considered if they could be unambiguously attributed to water salinity (eg. taste, calcification) or if they were generally regarded by respondents as a feature of water salt content (dryness of skin and hair, itchiness, staining of tiles).

- Outliers and factors dependent on the length of stay in the area are excluded.

In exercises such as the one described here the generalisability of results is needed. Ultimately the generalisability of the results will depend on the reasonableness of the estimates, and thus an exposition of the underlying logic of behavioural changes is required. While the "newcomer" survey was used to indicate the range and scope of behavioural adjustments the "quantitative" survey (and feedback from professional service providers in the area) was used to gauge the reasonableness of the statements made in the "newcomer" survey. This approach provided the triangulation needed to verify the reliability and validity of the findings.

Water salinity has an immediate effect on household finances in two major regards:

- the palatability of water, and

- the use of soaps and detergents.

5.3.1. Palatability

Palatability was affected first and often measures to counteract this effect cost the most. For many respondents the differences in the taste and the appearance of the water renders it significantly less palatable, and induces perceptions of unpotability if not treated. Households react in a number of ways:

- Decreasing the amount of water imbibed. These efforts are normally accompanied by the increased use of substitutes.

- Attempting to alter the effects of salinity on taste by allowing the water to stand, by refrigerating it, or by using additives to alter the impact of the salinity. Although these efforts may affect household members' health (many of the additives pose risks to health) the direct financial impact is negligible as households tend to use existing facilities (fridges) and minuscule quantities of additives purchased for other purposes (Jik, seawater).

- Flavouring the water or substituting it with cold drinks, tea, coffee, *et cetera*. This has by far the greatest economic impact on households. Most households reporting the substitution of water revert to the use of carbonated drinks as an alternative. The choice of this alternative is, in part, determined by the climactic and social conditions of the area. The cost impact of this is often of such a degree that it outweighs the combined effect of all other costs of increased salinity.

Despite the major cost implications there are strong indications that these measures tend to be of an interim nature. Despite the strength of many initial reactions to the taste of the water, residents do grow accustomed to the taste. Ultimately it is extremely difficult to ascribe changes in patterns of, for example, the consumption of carbonated beverages solely to the taste of the water. Although the taste of the water may initially compel residents to consume more cold drinks, other factors are of significance. For example newly urbanised informal settlement residents experience both the improved accessibility to refrigerated drinks and to an environment that supports the consumption of such drinks. As indicated above it has been assumed that the taste of the water will ultimately be accepted and no

financial cost would then be associated with the change in taste. No financial costs are thus reflected for this item. This may lead to an understatement of the cost to households of increased salinity.

5.3.2. Soaps and detergents

The immediate and unambiguous costs of increased salinity thus rest with the impact of increased salinity on soaps and detergents.

In this regard the main effects attributed to salinity are:

- Soaps and detergents do not foam as readily. They are thus seen to be less effective. The response of residents is primarily to use more soaps and detergents or to move to different (usually more expensive or more concentrated) brands. Such increases are evident in the consumption of laundry detergents and soaps, body soaps and dishwashing liquids.

- Body ablutions are more prone to leave skin sensitive or fragile. The itchiness or dryness of skin after bathing or the washing of dishes is directly attributed to the water salinity. Indications are that this might be the result of incomplete removal of soaps after washing. Most (64 percent) households reported that at least one household member suffered from itchy skin after bathing. Households respond by applying hand and body creams after ablutions. A distinct increase in the use of such products is evident in all sample categories.

- The water is attributed with leaving hair drier, more fragile and prone to falling out. Here respondents react by increasing the frequency and quantity of shampoo, conditioner and glycerine usage. Several respondents in areas not serviced by in-door plumbing reported that they have abandoned washing their own hair and now frequent hair salons.

Subject to the assumptions set out elsewhere it is possible to quantify the impact of increased salinity on these items of household consumption for township, shack and suburban households. These are dealt with separately.

5.4. TOWNSHIP HOUSEHOLDS

As a rule township residents enjoy access to electricity and the associated benefits. However, the lower income of these households precludes them from making as much use of these benefits as suburban households. As will be seen the effect of increased water salinity on township household budgets for consumables is greater than on healthier suburban budgets for consumable items. Only part of this can be attributed to the greater household size in townships. Another significant factor may be the pre-existing tendency of suburban households to "overdose" their laundry with detergent. Consequently, few dividends are seen after increasing the amount of detergent used. In addition the suburban households (who as a rule enjoy higher incomes) are more likely to use appliances in which the detergent dosage is fixed. The increment in suburban household detergent budgets is thus reduced.

One factor leading to the aggravation of the effect of increased salinity on township household budgets is that these households (in particular) are being forced into some markets for the first time. Many respondents indicated that the water quality was inducing them to buy hair conditioners, bleaches, shampoos, descalers and fabric softeners for the first time. The magnitude of the increase for township household budgets reflects their entry into these markets. The increases have been expressed as monetary values and (for illustrative purposes) the quantitative equivalent of popular brands. The increase in total monthly household expenditure is made up by purchases in the following categories: a) laundry cleaning and treatment, b) personal care items, c) dishwashing and general cleaning.

5.4.1. Laundry and Textile Treatment

The biggest economic impact on township consumer budgets lies in laundry detergents and other additives. There is a popular perception that the salinity is more inclined to cause the discoloration of clothing. This effect is particularly pronounced on white garments. In this regard supporting evidence is presented by respondents in references to the colour of tap water particularly after the water has been standing. Residents overcome this effect by washing textiles more thoroughly - using more detergent, or using bar soap with more "elbow grease", and by using Bleach, and similar products, to bleach clothing. The water salinity is also attributed with making "synthetic" textiles more abrasive. This forces households to make use of fabric softeners.

One of the single biggest increases in expenditure is that of laundry detergents which increases by R6,07 per month. This is equivalent to 0,68 kg of a well known brand of washing soap powder. This amount is further supplemented by an increased expenditure of R2,07 on laundry soap. Furthermore, the addition of another increase - the R5 spent on fabric softeners also needs to be taken into account. This is equivalent to 607 ml of fabric softener. All considered, the township household budget for the washing, bleaching and softening of clothing and other textiles increased by approximately R16 per month:

Washing powder	R 6,07	687 g
Laundry soap	R 2,07	402 g
Bleach	R 2,93	750 ml
Softner	R 5,01	607 ml
Total	**R16,08**	

5.4.2. Personal care items

For township residents the increases affecting consumer budgets do not stop with laundry products. Many township households indicated that they were no longer able to use soaps or detergents for the washing of their hair and had to resort to shampoos or hair salons. The water was attributed with making their hair dry and was directly held responsible for hair falling out. This was a pronounced effect in both informal settlements and township households.

As indicated above this effect was addressed in a number of ways:

- less frequent washing of hair
- increased use of salons
- purchase of shampoos for washing
- purchase of conditioners and glycerine for the treatment of hair

Accompanying this effect on hair was the drying of skin after bathing and itchiness - something that affected children more severely. This was addressed partly by the changing of soap brands, but the primary mechanism was the purchase of body creams for use after bathing. The pervasive expansion of the use of body creams results in creams being the single biggest contributor to the increased cost of approximately one Rand per person or R6,33 per household for township households. This is approximately 165 g of body cream.

An additional R3,69 per household is spent on shampoos (equivalent to 122 ml shampoo per household). The financial cost of increased use of hair salons has not been incorporated into the estimates primarily because this may reflect social and market pressure rather than the unambiguous impact of increased water salinity. Additional smaller increases are evident from the increased use of bath foams (and other bath oils) and by an increase in the consumption of body soap. Surprisingly the latter increase was equivalent to only a fraction of one bar of soap per household per month. The sum of increases in personal care items expenditure was R12,17 per household in townships:

Shampoo	R 3,69	122 ml
Bath foam	R 1,82	230 ml
Body Cream	R 6,33	165 g
Body soap	R 0,33	31 g
Total	**R12,17**	

5.4.3. Dishwashing and General Cleaning

Respondents indicated that the water quality affected their cleaning of utensils in several ways:

- Detergents and soaps did not foam or work as well, forcing them to use more concentrated products and apply more effort.
- Scale tended to form on pots, pans and other household items that came into regular contact with the water. Taps and even wall and floor tiles were believed to be more prone to scaling, which was difficult to remove.
- The discoloration of utensils, basins, toilets and tiles was attributed to the increased water salinity.
- Steam irons and electric kettles require regular descaling or the modification of their use (e.g. using them as regular flat irons).

Despite the above-mentioned effect of the water, the economic impact of counter measures was relatively small. The combined increase in consumption of scourers, chemical cleaners and descalers amounted to R5,05 per township household - less than the cost increase for body creams:

Scouring pads	R1,74	3,3
Chemical descalers	R1,01	48 ml
Chemical cleaner	R0,12	22 ml
Dishwashing liquid	R2,18	22 ml
Total	**R5,05**	

5.4.4. Total cost

The total cost to township households of increased salinity amounts to approximately R33,30 per month. The tendency for respondents to overstate the cost of the increasing salinity has to be considered. However, in partial confirmation of the tendency, 55 percent of township households indicated that they were willing to pay more for water of a better quality. This percentage is surprisingly high given the context of recurrent disputes over payment for services and objections surrounding non-delivery or poor delivery of services.

5.5. SHACK DWELLERS

Households in the informal settlements differ from township households in several important regards, such as quality of the housing, level of service enjoyed, household size, household income and in expectations. Many new arrivals to the informal settlements come from areas in which the water was both of poorer quality and less accessible than in their new surroundings. This leads to a relatively great level of satisfaction with the water quality. Nevertheless, 77 percent of households said they would be prepared to pay more for water of better quality.

5.5.1. Laundry and textile treatment

One-third of all the increased costs incurred by informal households lies in the expanded use of laundry detergent and laundry bar soaps. This increase amounts to a cost of R5,81. The next largest single cost increase lies in fabric softeners in which an additional cost of R2,27 is incurred. Increases associated with laundry washing, bleaching and softening amounts to R8,70 - two thirds of the total cost.

✳	Laundry detergent	R4,16
✳	Laundry bar soap	R1,65
✳	Fabric softener	R2,27
✳	Bleach	R0,60
✳	Total	R8,70

5.5.2. Personal care products

The second biggest category of cost increases is in "personal care" products which is again dominated by the purchase of body creams. The total cost increase for this category is somewhat less than would be inferred from the township household profile; it amounts to an additional R2.37. Many informal settlement respondents complained that the water made their hair dry and brittle. The most frequent response was to refer hair care to salons rather than to purchase additional hair care products (again the cost impact of salons was neither considered nor reflected in estimates.)

✳ Body creams	R1,39
✳ Hair conditioner	R0,67
✳ Shampoo	R0,25
✳ Bar soap	R0,04
✳ **Total**	**R2,37**

5.5.3. Dishwashing

Additional purchases of scourers, dishwashing agents and other cleaning chemicals amount to R1,99 per month. Of this, almost half is in the form of purchases of additional dishwashing liquid.

Scourers	R0,62
Cleaners	R0,53
Dishwashing liquid	R0,84
Total	**R1,99**

5.5.4. Total cost

The cost of increased water salinity to informal households is approximately R13 per month. Although this is substantially less than the costs incurred by the township households it is a greater relative increase when considered against household income.

5.6. SUBURBAN HOUSEHOLDS

Perhaps with its higher level of service and greater income it would be natural to expect that the suburban households would be the most affected by an increase in expenditure on consumables. This is, however, not the case. The total increase to these households amounts to R18,06 as opposed to R33,30 for township households. The pattern of expenditure demonstrated by suburban households differs substantially from that in townships. The biggest difference in expenditure on consumables is due to personal care items (accounting for 57 percent of the increase in expenditure on consumables in suburban households).

5.6.1. Laundry and textile treatment

Partly due to the aforementioned consumption patterns (overdosing) in suburban households the increase in this category is not as large as anticipated. Another explanatory factor is the high penetration of the market by all the products which counteract salinity. For example the widespread penetration of fabric softeners and hair conditioners in the suburban market precludes entry by significant numbers of new households into the market. Other factors include the more widespread use of automatic washing machines and dishwashers in which the dosage of detergent is predetermined.

The single biggest increase in laundry-related items is in detergents in which an increase of R2,65 is evident. This is followed by an increase of R1,12 in expenditure on bleaches, equivalent to 340 g of Skip and 284 ml of Bleach.

Detergent	R2,65
Bleach	R1,12
Fabric softener	R0,80
Total	**R4,57**

5.6.2. Personal care

More than half the increase in expenditure on personal care products is on body creams (R5,65). This, again, is a response to the dryness and itchiness of skin after bathing. Other increases are due to purchases of shampoos and hair conditioners (R2,00 and R1,26 respectively). These are equivalent to 124 ml of body cream, 83 ml of hair shampoo and 80 ml of hair conditioner.

Body cream	R5,65
Shampoo	R2,00
Hair conditioners	R1,26
Foam bath	R0,92
Body soap	R0,63
Total	**R10,46**

5.6.3. Cleaners and dishwashing agents

The widespread use of microwave ovens and higher quality (Teflon-coated, *etc.*) utensils reduces both the number of items requiring washing and increases the ease with which items can be washed. The most significant change in expenditure on cleaning agents was a R1,97 increase in purchase of chemicals used to descale kettles, basins, pots etc. This was equivalent to 93 ml of descaler. Far smaller increases are evident in the purchase of liquid detergents, scourers and other cleaners (e.g. Handy Andy).

Chemical descalers	1,97
Dishwashing liquid	0,73
Scourers	0,23
Cleaners	0,10
Total	**3,03**

5.6.4. Total cost

The total cost for suburban households amount to approximately R18,06 per month.

5.7. EFFECT ON DURABLE ITEMS

Household appliances in which water is heated are prone to accelerated calcification as a result of increased water salinity. As a result it was expected that the repair and replacement of durable items such as kettles, steam irons and washing machines would form a substantial component of the cost of increased water salinity.

However, the survey reveals that increased expenditure on durable items is substantially less than the increase in expenditure on either consumables or the cost of repairing or replacing "capital" items. In effect the impact of increased salinity was confined to three items: kettles, steam irons and filters for drinking water.

Households were asked what costs were incurred in maintaining or replacing items damaged by the increased salinity. These costs were then standardised and normalised. After this the costs were weighted by the "penetration" of appliances of that type into each area. The cost estimates are reflected below. (The extent to which appliances are used in household sectors are reflected in Annexure A).

* Electric kettles

Additional cost per household (by sector)

Informal	R0,00
Township	R0,22
Suburban	R0,83

* **Steam iron**

Additional cost per household (by sector)

Informal	R0,00
Township	R0,64
Suburban	R1,10

* **Water filters**

Additional cost per household (by sector)

Informal	R0,00
Township	R0,00
Suburban	R0,06

5.8. CAPITAL GOODS

Due to the small sample size and the intermittent nature of investments in capital items, it was anticipated that estimates for this expense category would present the greatest difficulties. Efforts were made to find alternative estimates to support or refute the survey findings. These efforts included interviews with professional service providers in the area who provided estimates of costs and descriptions as to the effect of the increased salinity. As the professional sector is inclined to deal only with affluent sectors of the communities their input was used only to ensure that household claims were within appropriate parameters and that the ostensible effects of the water could be directly attributed to its salinity. All estimates were based on inputs from households while input from the professional sector was used only to ensure that the replies recieved from households interviewed were understood. The survey reveals that although the accelerated depreciation or replacement of capital items such as geysers can be substantial, greater expenses were incurred for swimming pools and motor vehicles.

5.8.1. Geysers

One of the biggest suppliers of housing in both Klerksdorp and Welkom is the Anglo American Mining Corporation. This organisation provides housing for, *inter alia*, a large number of employees housed in formal, fully serviced dwellings. Their experience has led them to adopt a policy of changing electric geysers on these properties at regular six-year intervals. This is approximately half the normal lifespan of geysers in lower-salinity areas. The calculations for geysers have been made on the basis of this experience.

Although almost all suburban households have hot-water geysers, approximately one-quarter of these are gas instruments. Allowing for this "penetration" rate and for the accelerated rate of depreciation the estimated **additional** depreciation of this investment is R6,32 per month.

This figure is remarkably close to that derived directly from the survey using the original methodology which amounted to R6,67. This coincidence serves to affirm the methodology in the most problematic areas of costing.

Township households have both a much lower incidence of geysers and a different usage pattern. For economic and other reasons these households minimise their use of electricity for heating masses of water. Even if there is a geyser it is not used to the same extent as in the suburbs. Furthermore, in the event of a breakdown, township residents are apt not to repair or replace the instrument quickly. No township respondent reported repairing or replacing a geyser. It has been assumed that a geyser has a normal lifespan under these usage conditions. It thus follows that no additional costs are incurred for this item by township households, neither did households in the informal sector incur this additional cost (they do not enjoy access to electric geysers).

5.8.2. Taps, tap washers and piping

In houses the next highest additional costs regarding capital goods lie in the repair and replacement of taps and their components. The increased salinity is seen as contributing to leaks and resulting in encrustations, brittle washers and the calcification of taps and pipes. Taps themselves become discoloured or unsightly, ensuring that additional costs are incurred in repairing and replacing them for aesthetic reasons.

Additional cost per household (by sector)

Informal	R0
Township	R0
Suburban	R7,95

5.8.3. Pools and pool filters

Respondents accredited the increased water salinity with the accelerated calcification of pool filters and discoloration of pools. These costs amount to R19,09 for each household with a pool. However only about 19,7 percent of suburban households have a pool.

Additional cost per household (by sector)

Informal	R0
Township	R0
Suburban	R3,76

5.8.4. Vehicle maintenance

Increased water salinity is attributed with a small number of vehicle problems which are relatively expensive to repair. These fall into two categories:

* Premature battery failure (probably caused by the topping up of batteries with tap rather than distilled water).

* Calcification of car radiators. Severe calcification may lead to overheating and may damage vehicle cylinder heads. Repair of these items may cost thousands of Rands.

On average, costs directly attributed to increased salinity amounted to R12,49 per month for each household with a vehicle. Almost all suburban households (90,5 percent) had at least one vehicle. In the informal sector, penetration of vehicles dropped to 8,4 percent of households.

Additional cost per household (by sector)

Informal	R1,04
Township	R2,23
Suburban	R11,30

5.9. SUMMARY: TOTAL COSTS

The results show that the increased salinity has a notable and measurable effect on household expenditure profiles - primarily through the purchase of cleaning agents. The overall cost to households is between 1,3 and 2,8 percent of total household expenditure (depending on residential sector). The highest impact is on households in townships and the smallest effect is on households living in the suburbs. Combining the increases in the costs of consumables, durables and capital items as indicated results in a total cost estimates per household per month of:

* Informal sector R14,10
* Townships R36,39
* Suburbs R49,38

(including costs of repairs to motor vehicles)

The Heynike (1983) report indicated that households in the OFS Goldfields, Klerksdorp and the PWV complex incurred an additional cost of R134 million as a result of increasing water salinity. At 1996 values this would be equivalent to approximately R637 million. Assuming a population of 1,3 million households in the catchment area the monthly cost per household would approximately be R40 (for all household types) at current Rand value. This is approximately equal to the estimate for the sector most affected - suburban households. However the estimate includes several items, particularly repairs to motor vehicles, not accounted for in the Heynike report. In effect the total estimated cost to households arrived at in this study is significantly less than that arrived by Heynike's technicist approach.

The overestimation in the Heynike report may be due to a number of factors. Instead of responding to increased salinity in a way sensitive to technical requirements, households are likely to respond in a *way more sensitive to their incomes, access to services, and social and household conditions.* The current study is more sensitive to these aspects of behaviour.

The Heynike report overstates the impact of salinity on household appliances. The current study has shown that there is only a marginal effect on the longevity and serviceability of these appliances. This is partly the result of the more extensive use of rubber, plastic and stainless steel in the manufacture of modern appliances.

Support for the lower cost estimates is offered by a United States report of salinity authored by Metcalf and Eddy (1972). The authors state:

No significant correlation between cost and water quality are evident for

- *Damage to clothing, dishes and glassware*
- *Damage to lawns and plants (residential only)*
- *Plumbing repair and replacement in the home*
- *Use of bottled beverages (excluding bottled water)"*

Moreover, according to detergent and other manufacturers their products are based on formulae which take into account the most saline conditions likely to be encountered. This assurance refutes the notion reflected in the technicist approach that the effects of increased salinity is compensated for by continually increasing detergent dosages. Rather the extent to which dosages are increased, reflects water salinity and access to services and disposable income. The current study is more sensitive to the latter factors than the technicist approaches are.

6. INPUT DATA FOR MODELING

The analysis of the cost to households of increased salinity was central to informing the general model pursued by the wider study. The estimates used to inform that model are presented below.

Information needed to estimate the cost to households would ideally contain:

- an estimate of the lifespan of items under "normal" conditions (i.e. normative TDS levels)
- the lifespan of the appliance at the higher TDS levels
- the replacement cost of the item.

The difference in the lifespan could then be weighted by the cost of the item to reveal a cost attributable to the increase salinity for any given period. This method is not viable for a number of reasons. For one, the lifespan of items under "normal" conditions is not known (assuming that such a condition could be adequately described). The lifespan of geysers, for example, are affected by TDS and by frequency of, use volume of water heated, salient temperature, size of geyser etc. These factors are determined by cultural as well as economic factors, by climate and by a myriad of other variables. The lifespan of items at higher salinity levels is similarly subject to a plethora of factors. To overcome this problem it was essential to by-pass this method.

The general formula has been modified to rely on only the following:

- the replacement cost (or repair cost) if the item
- the frequency of repair/ replacement attributable to salinity

For durable and capital items these two variables are then subject to a process of normalisation in which the cost to the household is disbursed over the period of wear/ depreciation. This cost is annualised to reflect a constant rate of depreciation. This rate of depreciation is then adapted to compensate for household size and the extent to which the item is utilised by the population as a whole (the penetration rate). The latter modification has been referred to as the "standardisation". The advantage of this method is that a baseline (that reflecting "normative" behaviour) is not required except in so far as a benchmark for TDS is concerned. In light of the origin of participants in the newcomer survey the TDS baseline can be set at that predominant in the Johannesburg/ Pretoria district. This district was considered as having a "normal" TDS by most respondents.

In as far as consumable items like soaps and detergents are concerned, the study was used to calculate the additional consumption attributable to increased salinity. The estimates are thus based on actual consumption rather than on behaviour anticipated by technical criteria or assumptions of optimal responses. In practice (and income permitting) households tend to exceed the optimal dosage indicated by technical criteria. This renders the technicist assumptions void. The method adopted in this study skirts the need for any such baseline. The sample has been designed to identify households in which the economic and cultural fabric of households has largely been preserved on their entry into the high salinity area making it possible to attribute effects to salinity with greater certainty.

With regard to washable fabrics the advisability of using this methodology is highlighted. The reduced lifespan of clothes and other textiles resulting from more frequent, vigorous washing was not manifest in responses. This does not imply that respondents were unaware of the effects of increased salinity of garments. Households tend to perceive its impact differently and appear to move to pre-empt its effects. The effect of salinity is more evident in the texture of garments than on its longevity. The lifespan of garments are determined more by fashion, comfort and image rather than on its technical lifespan. This factor is particularly important when noting that the lifespan of garments is reduced by only two or three percent by increased salinity.

Rather than changing the lifespan of garments, salinity tends to alter the tensile strength of fabrics making them more abrasive and less comfortable. Households react to this through the increased use of fabric softeners rather than by discarding or replacing clothing etc. Analysts are often forced to assume that such behaviour is determined by economic rationality and that the increased expenditure on fabric softener does not exceed the replacing garments more often.

Household behaviour is replete with instances in which costs are similarly transferred to other "budgets". The ability to attribute effects of costs in one category of expenditure in only that category is undermined. In the above example the costs of accelerated depreciation of textiles is borne by the households' detergent budget. The effects of salinity have thus to be examined in a holistic manner and in a way that examines actual practice.

The differential impact on households of differing social and economic circumstances has been incorporated by adopting an appropriate proxy - household type. Relying on a close correlation between household type, income and service enjoyed households have been grouped into three primary categories:

- suburban (high income, high services)
- township (intermediate income and service levels)
- informal (low income and low service levels)

This categorisation largely coincides with cultural behaviour in so far as the degree of urbanisation is concerned. The general equation for estimating the cost of increased salinity for any one household sector is:

$$\left[\sum_0^n \left((\Delta Cdterg_n / hhsize_n) + (\Delta Csoap_n / hhsize_n) + (\Delta Cxx_n / hhsize_n) + (.....)\right) Av.hhsize\right] / n$$

n	interview number in that household sector
Cdterg	the increased household monthly cost of detergents attributable to salinity
Csoap	the increased household monthly cost of soaps attributable to salinity
Cxx	the increased household monthly cost of the next item attributable to salinity. All costs attributable to increased salinity are included
hhsize	the size of the household
Av.hhsize	the average household size in that sector

The summarised results inputted into the model are (average monthly costs by sector):

Sector	**Suburban**	**Informal**	**Township***
Laundry	R4.57	R8.70	R16.08
Personal care	R10.46	R2.37	R12.17
Dishwashing etc.	R3.03	R1.99	R5.05
Electric kettles	R0.83	R0.00	R0.22
Steam irons	R1.10	R0.00	R0.64
Water filters	R0.06	R0.00	R0.00
Geysers	R6.32	R0.00	R0.00
Taps and piping	R7.95	R0.00	R0.00
Pools	R3.76	R0.00	R0.00

Sector	Suburban	Informal	Township*
Vehicles	R11.30	R1.04	R2.23
Total	**R49.38**	**R14.10**	**R36.39**

As noted above hostel residents should be considered on the basis of the per capita cost to township households. Alternatively the number of hostel residents should be discounted by a factor of 5.9 and treated as a reduced number of township households.

7. CONCLUSION

One of the objectives of the study was to estimate the costs across a range of salinity values. The current study provides only two points of any graphical projection that can be made. The first point is the normative condition at which no additional costs for water salinity are discernible. In effect this point is the mean of the salinity values at those places from which the newcomers came - effectively the value in Johannesburg and Pretoria. The second point is at that value prevailing in the Klerksdorp and Welkom areas. This second point is associated with the calculated increment. Extrapolations beyond this latter value would intuitively be reflected by a decreasing curve in which increasing salinity values are associated with ever smaller increments in cost. However the general practice for all the studies referred to is to reflect a linear correlation between salinity and incremental cost. This practice has been adopted by both the studies of a technicist nature (Heynike (1987), United States Department of the Interior (1980), Andersen and Kleinman (1978), United States Department of the (1974)) and by Metcalf and Eddy (1972). In the absence of estimates of the changes in the slope of the curve it is expedient to follow this general practice.

The Heynike report was criticised because the cost of increased salinity *"...will in most cases be subject to considerable degrees of uncertainty"*. As this inevitably applies to the current study as well, an articulation of that uncertainty may be of some assistance.

One of the main problems associated with the method employed is the inevitably small sample size and the consequent variance in results. This leads to a lack of statistical certainty. However the original claim of the study was that it would only indicate the nature and general costs of increasing water salinity. This variance is particularly great in poorer households and with respect to capital expenditure. The former is a result of fluctuations in income and the latter of the infrequency and great cost of repairs to capital items.

With respect to consumable items, Variability can be reflected by indicating the number of respondents likely to incur a cost of between R0 (i.e. no cost) and a value twice the mean (i.e. the estimates presented above). If a household falls below the R0 range it experiences a saving as a result of increased salinity. This happens only in households that moved into the area from regions in which the water, albeit of low-salinity, was of poor quality. The water in the survey regions was then seen as being of superior quality. Obviously the socio-economic sector most affected by this was the informal sector. Although households are equally likely to fall on either side of this range, savings as a result of increased salinity are marginal. On the other hand those costs incurred as a result of increased salinity are occasionally well above the average.

Among informal sector households 77 percent of respondent households fell into the prescribed range (i.e. 0<n<=2n). Among suburban households 94 percent fell within this prescribed range. Of the township households 85 percent fell within the range. The variance with respect to capital items is much greater.

These comments have been introduced only to indicate the range of costs incurred. However, the comments and assumptions indicated at the beginning of the report must be borne in mind as must the central "conundrum" of trading off useful information against representativeness (and thus "certainty").

REFERENCES

Andersen, J.C. & Kleinman, A.P. 1978. Salinity management options for the Colorado River. Water Resources Planning Series Report p-78-003. Utah Water Research Laboratory, Utah State University.

Black, T. 1993. Evaluating social science research: an introduction. London: Sage.

Frost, P & Stablein, R. (eds) 1992. Doing exemplary research, London: Sage.

Harvey, L. 1990. Critical social science research. London: Unwin Hyman.

Heynike, J.J.C. 1987. Water Research Commission Report on Salination of Vaal River Water: Economic Effects.

Metcalf & Eddy, 1972. The economic value of water quality. Research and Development Progress Report no. 779. Office of Saline Water, US Department of the Interior.

Perreault, W.D. Jr. & Leigh, L.E. 1989. reliability of nominal data based on qualitative judgements, Journal of Marketing Research, Vol. XXV1, pp. 135-148.

Rascher, J.H. Toepassing van kwalitatiewe navorsingsmetode in 'n stedelike volkekundige navorsingsprojek, Suid-Afrikaanse Tydskrif vir Etnologie, Vol. 16, no. 2, pp. 46-52.

Smith, R.B & Manning, P.K. (eds) 1982. Handbook of social science methods, Vol. 2: Qualitative methods. Cambridge, Massachusetts: Ballinger.

United States Department of the Interior 1974. Colorado River water quality improvement program, status report. Bureau of Reclamation. US Department of the Interior

United States Department of the Interior. 1980. Colorado River salinity. Economic impacts on agricultural, municipal and industrial users. Colorado River Water Quality Office, Engineering and Research Centre, Denver, Colorado.

Index to Tables

TABLE 1: Area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Suburban	137	137	0	0	132	5	131	6	68	56	13
	39.37	100.00	0.00	0.00	63.16	3.60	76.16	3.41	64.15	40.29	12.62
		100.00	0.00	0.00	96.35	3.65	95.62	4.38	49.64	40.88	9.49
Township	128	0	128	0	77	51	41	87	13	54	61
	36.78	0.00	100.00	0.00	36.84	36.69	23.84	49.43	12.26	38.85	59.22
		0.00	100.00	0.00	60.16	39.84	32.03	67.97	10.16	42.19	47.66
Informal settlements	83	0	0	83	0	83	0	83	25	29	29
	23.85	0.00	0.00	100.00	0.00	59.71	0.00	47.16	23.58	20.86	28.16
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	30.12	34.94	34.94
MEAN	1.84	1.00	2.00	3.00	1.37	2.56	1.24	2.44	1.59	1.81	2.16
S.D.	0.78	0.00	0.00	0.00	0.48	0.57	0.43	0.56	0.85	0.76	0.62
Chi Square		696.00			200.02		213.56		68.20		
		p=.001			p=.001		p=.001		p=.001		

TABLE 2: Years household has lived in this area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
One	21	12	2	7	11	10	13	8	6	9	6
	6.29	9.68	1.56	8.54	5.61	7.25	8.18	4.57	6.06	6.72	5.94
		57.14	9.52	33.33	52.38	47.62	61.90	38.10	28.57	42.86	28.57
Two	23	12	1	10	12	11	11	12	7	9	7
	6.89	9.68	0.78	12.20	6.12	7.97	6.92	6.86	7.07	6.72	6.93
		52.17	4.35	43.48	52.17	47.83	47.83	52.17	30.43	39.13	30.43
Three	17	5	2	10	5	12	6	11	6	6	5
	5.09	4.03	1.56	12.20	2.55	8.70	3.77	6.29	6.06	4.48	4.95
		29.41	11.76	58.82	29.41	70.59	35.29	64.71	35.29	35.29	29.41
Four	19	4	6	9	8	11	6	13	4	10	5
	5.69	3.23	4.69	10.98	4.08	7.97	3.77	7.43	4.04	7.46	4.95
		21.05	31.58	47.37	42.11	57.89	31.58	68.42	21.05	52.63	26.32
Five	30	9	11	10	19	11	14	16	12	10	8
	8.98	7.26	8.59	12.20	9.69	7.97	8.81	9.14	12.12	7.46	7.92
		30.00	36.67	33.33	63.33	36.67	46.67	53.33	40.00	33.33	26.67
Six	26	4	8	14	8	18	6	20	7	16	3
	7.78	3.23	6.25	17.07	4.08	13.04	3.77	11.43	7.07	11.94	2.97
		15.38	30.77	53.85	30.77	69.23	23.08	76.92	26.92	61.54	11.54
Seven	24	7	11	6	15	9	11	13	6	8	10
	7.19	5.65	8.59	7.32	7.65	6.52	6.92	7.43	6.06	5.97	9.90
		29.17	45.83	25.00	62.50	37.50	45.83	54.17	25.00	33.33	41.67
Eight	15	5	6	4	11	4	10	5	6	5	4
	4.49	4.03	4.69	4.88	5.61	2.90	6.29	2.86	6.06	3.73	3.96
		33.33	40.00	26.67	73.33	26.67	66.67	33.33	40.00	33.33	26.67
Nine	11	6	4	1	9	2	7	4	1	8	2
	3.29	4.84	3.13	1.22	4.59	1.45	4.40	2.29	1.01	5.97	1.98
		54.55	36.36	9.09	81.82	18.18	63.64	36.36	9.09	72.73	18.18
Ten	12	4	7	1	8	4	5	7	5	3	4
	3.59	3.23	5.47	1.22	4.08	2.90	3.14	4.00	5.05	2.24	3.96
		33.33	58.33	8.33	66.67	33.33	41.67	58.33	41.67	25.00	33.33
11	7	5	0	2	5	2	5	2	1	3	3
	2.10	4.03	0.00	2.44	2.55	1.45	3.14	1.14	1.01	2.24	2.97
		71.43	0.00	28.57	71.43	28.57	71.43	28.57	14.29	42.86	42.86

TABLE 2: Years household has lived in this area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
12	3	3	0	0	3	0	3	0	1	2	0
	0.90	2.42	0.00	0.00	1.53	0.00	1.89	0.00	1.01	1.49	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
13	2	1	1	0	1	1	1	1	0	1	1
	0.60	0.81	0.78	0.00	0.51	0.72	0.63	0.57	0.00	0.75	0.99
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	0.00	50.00	50.00
14	3	0	1	2	1	2	0	3	1	1	1
	0.90	0.00	0.78	2.44	0.51	1.45	0.00	1.71	1.01	0.75	0.99
		0.00	33.33	66.67	33.33	66.67	0.00	100.00	33.33	33.33	33.33
15	10	3	7	0	8	2	4	6	1	5	4
	2.99	2.42	5.47	0.00	4.08	1.45	2.52	3.43	1.01	3.73	3.96
		30.00	70.00	0.00	80.00	20.00	40.00	60.00	10.00	50.00	40.00
16	6	2	4	0	5	1	3	3	2	2	2
	1.80	1.61	3.13	0.00	2.55	0.72	1.89	1.71	2.02	1.49	1.98
		33.33	66.67	0.00	83.33	16.67	50.00	50.00	33.33	33.33	33.33
17	3	1	1	1	2	1	1	2	1	2	0
	0.90	0.81	0.78	1.22	1.02	0.72	0.63	1.14	1.01	1.49	0.00
		33.33	33.33	33.33	66.67	33.33	33.33	66.67	33.33	66.67	0.00
18	2	1	0	1	1	1	1	1	1	1	0
	0.60	0.81	0.00	1.22	0.51	0.72	0.63	0.57	1.01	0.75	0.00
		50.00	0.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
19	1	1	0	0	1	0	1	0	1	0	0
	0.30	0.81	0.00	0.00	0.51	0.00	0.63	0.00	1.01	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
20	12	7	4	1	9	3	8	4	6	4	2
	3.59	5.65	3.13	1.22	4.59	2.17	5.03	2.29	6.06	2.99	1.98
		58.33	33.33	8.33	75.00	25.00	66.67	33.33	50.00	33.33	16.67
21	5	4	1	0	3	2	3	2	3	0	2
	1.50	3.23	0.78	0.00	1.53	1.45	1.89	1.14	3.03	0.00	1.98
		80.00	20.00	0.00	60.00	40.00	60.00	40.00	60.00	0.00	40.00
22	1	0	1	0	1	0	0	1	1	0	0
	0.30	0.00	0.78	0.00	0.51	0.00	0.00	0.57	1.01	0.00	0.00
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	100.00	0.00	0.00

TABLE 2: Years household has lived in this area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
23	3	2	1	0	3	0	2	1	0	2	1
	0.90	1.61	0.78	0.00	1.53	0.00	1.26	0.57	0.00	1.49	0.99
		66.67	33.33	0.00	100.00	0.00	66.67	33.33	0.00	66.67	33.33
25	9	3	6	0	7	2	4	5	1	4	4
	2.69	2.42	4.69	0.00	3.57	1.45	2.52	2.86	1.01	2.99	3.96
		33.33	66.67	0.00	77.78	22.22	44.44	55.56	11.11	44.44	44.44
26	1	1	0	0	1	0	1	0	1	0	0
	0.30	0.81	0.00	0.00	0.51	0.00	0.63	0.00	1.01	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
27	3	1	2	0	3	0	2	1	0	2	1
	0.90	0.81	1.56	0.00	1.53	0.00	1.26	0.57	0.00	1.49	0.99
		33.33	66.67	0.00	100.00	0.00	66.67	33.33	0.00	66.67	33.33
29	2	0	2	0	0	2	0	2	1	1	0
	0.60	0.00	1.56	0.00	0.00	1.45	0.00	1.14	1.01	0.75	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	50.00	50.00	0.00
30	14	4	10	0	8	6	5	9	5	5	4
	4.19	3.23	7.81	0.00	4.08	4.35	3.14	5.14	5.05	3.73	3.96
		28.57	71.43	0.00	57.14	42.86	35.71	64.29	35.71	35.71	28.57
31	1	0	1	0	0	1	0	1	0	1	0
	0.30	0.00	0.78	0.00	0.00	0.72	0.00	0.57	0.00	0.75	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
32	3	1	2	0	3	0	3	0	0	1	2
	0.90	0.81	1.56	0.00	1.53	0.00	1.89	0.00	0.00	0.75	1.98
		33.33	66.67	0.00	100.00	0.00	100.00	0.00	0.00	33.33	66.67
33	4	2	2	0	3	1	3	1	1	2	1
	1.20	1.61	1.56	0.00	1.53	0.72	1.89	0.57	1.01	1.49	0.99
		50.00	50.00	0.00	75.00	25.00	75.00	25.00	25.00	50.00	25.00
34	2	1	1	0	1	1	2	0	1	0	1
	0.60	0.81	0.78	0.00	0.51	0.72	1.26	0.00	1.01	0.00	0.99
		50.00	50.00	0.00	50.00	50.00	100.00	0.00	50.00	0.00	50.00
35	8	2	5	1	4	4	3	5	1	3	4
	2.40	1.61	3.91	1.22	2.04	2.90	1.89	2.86	1.01	2.24	3.96
		25.00	62.50	12.50	50.00	50.00	37.50	62.50	12.50	37.50	50.00

TABLE 2: Years household has lived in this area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
36	2	1	1	0	2	0	1	1	0	1	1
	0.60	0.81	0.78	0.00	1.02	0.00	0.63	0.57	0.00	0.75	0.99
		50.00	50.00	0.00	100.00	0.00	50.00	50.00	0.00	50.00	50.00
37	1	0	1	0	0	1	0	1	0	1	0
	0.30	0.00	0.78	0.00	0.00	0.72	0.00	0.57	0.00	0.75	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
38	2	2	0	0	2	0	2	0	2	0	0
	0.60	1.61	0.00	0.00	1.02	0.00	1.26	0.00	2.02	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
39	1	1	0	0	1	0	1	0	0	0	1
	0.30	0.81	0.00	0.00	0.51	0.00	0.63	0.00	0.00	0.00	0.99
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
40	6	2	3	1	4	2	2	4	3	0	3
	1.80	1.61	2.34	1.22	2.04	1.45	1.26	2.29	3.03	0.00	2.97
		33.33	50.00	16.67	66.67	33.33	33.33	66.67	50.00	0.00	50.00
41	2	1	1	0	1	1	1	1	0	0	2
	0.60	0.81	0.78	0.00	0.51	0.72	0.63	0.57	0.00	0.00	1.98
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	0.00	0.00	100.00
42	1	0	0	1	0	1	0	1	1	0	0
	0.30	0.00	0.00	1.22	0.00	0.72	0.00	0.57	1.01	0.00	0.00
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	100.00	0.00	0.00
43	1	0	1	0	0	1	0	1	0	1	0
	0.30	0.00	0.78	0.00	0.00	0.72	0.00	0.57	0.00	0.75	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
44	3	1	2	0	2	1	2	1	0	1	2
	0.90	0.81	1.56	0.00	1.02	0.72	1.26	0.57	0.00	0.75	1.98
		33.33	66.67	0.00	66.67	33.33	66.67	33.33	0.00	33.33	66.67
45	1	0	1	0	0	1	0	1	0	0	1
	0.30	0.00	0.78	0.00	0.00	0.72	0.00	0.57	0.00	0.00	0.99
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
46	1	0	1	0	0	1	1	0	0	0	1
	0.30	0.00	0.78	0.00	0.00	0.72	0.63	0.00	0.00	0.00	0.99
		0.00	100.00	0.00	0.00	100.00	100.00	0.00	0.00	0.00	100.00

TABLE 2: Years household has lived in this area

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
48	2	1	1	0	1	1	1	1	1	1	0
	0.60	0.81	0.78	0.00	0.51	0.72	0.63	0.57	1.01	0.75	0.00
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
49	2	0	2	0	0	2	0	2	0	1	1
	0.60	0.00	1.56	0.00	0.00	1.45	0.00	1.14	0.00	0.75	0.99
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00
50	2	2	0	0	2	0	2	0	2	0	0
	0.60	1.61	0.00	0.00	1.02	0.00	1.26	0.00	2.02	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
52	1	0	1	0	0	1	0	1	0	0	1
	0.30	0.00	0.78	0.00	0.00	0.72	0.00	0.57	0.00	0.00	0.99
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
53	1	0	1	0	0	1	1	0	0	1	0
	0.30	0.00	0.78	0.00	0.00	0.72	0.63	0.00	0.00	0.75	0.00
		0.00	100.00	0.00	0.00	100.00	100.00	0.00	0.00	100.00	0.00
59	1	0	1	0	1	0	1	0	0	1	0
	0.30	0.00	0.78	0.00	0.51	0.00	0.63	0.00	0.00	0.75	0.00
		0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
60	1	0	1	0	1	0	0	1	0	0	1
	0.30	0.00	0.78	0.00	0.51	0.00	0.00	0.57	0.00	0.00	0.99
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	0.00	100.00
NO RESPONSE or NIL	14	13	0	1	13	1	13	1	7	5	2
MEAN	14.27	14.02	19.41	6.61	14.98	13.25	14.79	13.79	13.80	12.94	16.49
S.D.	13.49	12.82	14.78	7.39	12.99	14.16	13.61	13.40	12.92	12.60	14.97
Chi Square		147.48			64.33		56.28		94.73		
		p=.001			p=.084		p=.252		p=.630		

TABLE 3: Number of adults in household

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
One	33	16	9	8	22	11	19	14	24	6	3
	9.48	11.68	7.03	9.64	10.53	7.91	11.05	7.95	22.64	4.32	2.91
		48.48	27.27	24.24	66.67	33.33	57.58	42.42	72.73	18.18	9.09
Two	171	82	59	30	114	57	98	73	60	87	24
	49.14	59.85	46.09	36.14	54.55	41.01	56.98	41.48	56.60	62.59	23.30
		47.95	34.50	17.54	66.67	33.33	57.31	42.69	35.09	50.88	14.04
Three	69	24	22	23	36	33	31	38	22	26	21
	19.83	17.52	17.19	27.71	17.22	23.74	18.02	21.59	20.75	18.71	20.39
		34.78	31.88	33.33	52.17	47.83	44.93	55.07	31.88	37.68	30.43
Four	43	11	19	13	23	20	15	28	0	17	26
	12.36	8.03	14.84	15.66	11.00	14.39	8.72	15.91	0.00	12.23	25.24
		25.58	44.19	30.23	53.49	46.51	34.88	65.12	0.00	39.53	60.47
Five	17	1	10	6	7	10	2	15	0	3	14
	4.89	0.73	7.81	7.23	3.35	7.19	1.16	8.52	0.00	2.16	13.59
		5.88	58.82	35.29	41.18	58.82	11.76	88.24	0.00	17.65	82.35
Six	9	2	5	2	5	4	5	4	0	0	9
	2.59	1.46	3.91	2.41	2.39	2.88	2.91	2.27	0.00	0.00	8.74
		22.22	55.56	22.22	55.56	44.44	55.56	44.44	0.00	0.00	100.00
Seven	5	1	3	1	1	4	2	3	0	0	5
	1.44	0.73	2.34	1.20	0.48	2.88	1.16	1.70	0.00	0.00	4.85
		20.00	60.00	20.00	20.00	80.00	40.00	60.00	0.00	0.00	100.00
Eight	1	0	1	0	1	0	0	1	0	0	1
	0.29	0.00	0.78	0.00	0.48	0.00	0.00	0.57	0.00	0.00	0.97
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	0.00	100.00
MEAN	2.69	2.34	2.95	2.87	2.54	2.92	2.45	2.92	1.98	2.45	3.74
S.D.	1.28	0.99	1.46	1.27	1.19	1.37	1.14	1.36	0.66	0.84	1.56
Chi Square		27.20			12.89		20.26		134.32		
		p=.018			p=.075		p=.005		p=.001		

TABLE 4: Number of children in household

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
One	53	23	16	14	28	25	26	27	24	23	6
	20.00	28.75	13.68	20.59	18.92	21.37	22.41	18.12	75.00	17.69	5.83
		43.40	30.19	26.42	52.83	47.17	49.06	50.94	45.28	43.40	11.32
Two	84	31	31	22	47	37	39	45	8	62	14
	31.70	38.75	26.50	32.35	31.76	31.62	33.62	30.20	25.00	47.69	13.59
		36.90	36.90	26.19	55.95	44.05	46.43	53.57	9.52	73.81	16.67
Three	74	24	31	19	42	32	33	41	0	45	29
	27.92	30.00	26.50	27.94	28.38	27.35	28.45	27.52	0.00	34.62	28.16
		32.43	41.89	25.68	56.76	43.24	44.59	55.41	0.00	60.81	39.19
Four	28	2	20	6	17	11	13	15	0	0	28
	10.57	2.50	17.09	8.82	11.49	9.40	11.21	10.07	0.00	0.00	27.18
		7.14	71.43	21.43	60.71	39.29	46.43	53.57	0.00	0.00	100.00
Five	13	0	7	6	6	7	2	11	0	0	13
	4.91	0.00	5.98	8.82	4.05	5.98	1.72	7.38	0.00	0.00	12.62
		0.00	53.85	46.15	46.15	53.85	15.38	84.62	0.00	0.00	100.00
Six	9	0	8	1	6	3	3	6	0	0	9
	3.40	0.00	6.84	1.47	4.05	2.56	2.59	4.03	0.00	0.00	8.74
		0.00	88.89	11.11	66.67	33.33	33.33	66.67	0.00	0.00	100.00
Seven	3	0	3	0	1	2	0	3	0	0	3
	1.13	0.00	2.56	0.00	0.68	1.71	0.00	2.01	0.00	0.00	2.91
		0.00	100.00	0.00	33.33	66.67	0.00	100.00	0.00	0.00	100.00
20	1	0	1	0	1	0	0	1	0	0	1
	0.38	0.00	0.85	0.00	0.68	0.00	0.00	0.67	0.00	0.00	0.97
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	0.00	100.00
NO RESPONSE or NIL	83	57	11	15	61	22	56	27	74	9	0
MEAN	2.70	2.06	3.21	2.57	2.76	2.62	2.44	2.90	1.25	2.17	3.82
S.D.	1.71	0.83	2.17	1.25	1.94	1.37	1.16	2.02	0.44	0.71	2.14
Chi Square		36.66 p=.001			2.82 p=.901		8.71 p=.274		176.64 p=.001		

WRC Klerksdorp Water Salinity Survey

TABLE 5: Services available

Informal settlements

	RESPONSE TO QUEST		
	YES	NO	
	TOTAL		MEAN
Piped water in house	83 100.00	0 0.00	83 100.00	2.00
Piped water to stand	83 100.00	54 65.06	29 34.94	1.35
Communal tap	83 100.00	27 32.53	56 67.47	1.67
No tapped water	83 100.00	2 2.41	81 97.59	1.98
Flush toilet	83 100.00	17 20.48	66 79.52	1.80
Other toilet	83 100.00	62 74.70	21 25.30	1.25
Bath	83 100.00	0 0.00	83 100.00	2.00
Shower	83 100.00	0 0.00	83 100.00	2.00
Metered electricty	83 100.00	0 0.00	83 100.00	2.00
Prepaid elec	83 100.00	33 39.76	50 60.24	1.60
No mains	83 100.00	50 60.24	33 39.76	1.40
Elec geyser	83 100.00	0 0.00	83 100.00	2.00
Gas geyser	83 100.00	1 1.20	82 98.80	1.99
Wet battery	83 100.00	29 34.94	54 65.06	1.65

WRC Klerksdorp Water Salinity Survey

TABLE 5: Services available

Informal settlements

		RESPONSE TO QUEST		
	TOTAL	YES	NO	MEAN
Solar heater	83	0	83	2.00
	100.00	0.00	100.00	
Car	83	7	76	1.92
	100.00	8.43	91.57	
Bakkie	83	0	83	2.00
	100.00	0.00	100.00	
Truck	83	0	83	2.00
	100.00	0.00	100.00	
Garden sprinkler	83	15	68	1.82
	100.00	18.07	81.93	
Pool	83	0	83	2.00
	100.00	0.00	100.00	
NO RESPONSE or NIL	0	0	0	0.00
MEAN	100.00	17.89	82.11	
S.D.	0.00	24.84	24.84	

WRC Klerksdorp Water Salinity Survey

TABLE 5: Services available

Suburban

		RESPONSE TO QUEST		
	TOTAL	YES	NO	MEAN
Piped water in house	137 100.00	132 96.35	5 3.65	1.04
Piped water to stand	137 100.00	40 29.20	97 70.80	1.71
Communal tap	137 100.00	0 0.00	137 100.00	2.00
No tapped water	137 100.00	0 0.00	137 100.00	2.00
Flush toilet	137 100.00	135 98.54	2 1.46	1.01
Other toilet	137 100.00	11 8.03	126 91.97	1.92
Bath	137 100.00	132 96.35	5 3.65	1.04
Shower	137 100.00	60 43.80	77 56.20	1.56
Metered electricty	137 100.00	131 95.62	6 4.38	1.04
Prepaid elec	137 100.00	6 4.38	131 95.62	1.96
No mains	137 100.00	0 0.00	137 100.00	2.00
Elec geyser	137 100.00	104 75.91	33 24.09	1.24
Gas geyser	137 100.00	33 24.09	104 75.91	1.76
Wet battery	137 100.00	0 0.00	137 100.00	2.00

TABLE 5: Services available

Suburban

		RESPONSE TO QUEST		
	TOTAL	YES	NO	MEAN
Solar heater	137	0	137	2.00
	100.00	0.00	100.00	
Car	137	121	16	1.12
	100.00	88.32	11.68	
Bakkie	137	29	108	1.79
	100.00	21.17	78.83	
Truck	137	5	132	1.96
	100.00	3.65	96.35	
Garden sprinkler	137	29	108	1.79
	100.00	21.17	78.83	
Pool	137	27	110	1.80
	100.00	19.71	80.29	
NO RESPONSE or NIL	0	0	0	0.00
MEAN	100.00	36.31	63.69	
S.D.	0.00	39.30	39.30	

WRC Klerksdorp Water Salinity Survey

TABLE 5: Services available

Township

	RESPONSE TO QUEST		
	YES	NO	
	TOTAL		MEAN
Piped water in house	128 100.00	77 60.16	51 39.84	1.40
Piped water to stand	128 100.00	113 88.28	15 11.72	1.12
Communal tap	128 100.00	0 0.00	128 100.00	2.00
No tapped water	128 100.00	0 0.00	128 100.00	2.00
Flush toilet	128 100.00	119 92.97	9 7.03	1.07
Other toilet	128 100.00	11 8.59	117 91.41	1.91
Bath	128 100.00	41 32.03	87 67.97	1.68
Shower	128 100.00	10 7.81	118 92.19	1.92
Metered electricty	128 100.00	41 32.03	87 67.97	1.68
Prepaid elec	128 100.00	77 60.16	51 39.84	1.40
No mains	128 100.00	6 4.69	122 95.31	1.95
Elec geyser	128 100.00	26 20.31	102 79.69	1.80
Gas geyser	128 100.00	2 1.56	126 98.44	1.98
Wet battery	128 100.00	7 5.47	121 94.53	1.95

WRC Klerksdorp Water Salinity Survey

TABLE 5: Services available

Township

	RESPONSE TO QUEST			
	TOTAL	YES	NO	MEAN
Solar heater	128 100.00	0 0.00	128 100.00	2.00
Car	128 100.00	18 14.06	110 85.94	1.86
Bakkie	128 100.00	7 5.47	121 94.53	1.95
Truck	128 100.00	0 0.00	128 100.00	2.00
Garden sprinkler	128 100.00	25 19.53	103 80.47	1.80
Pool	128 100.00	0 0.00	128 100.00	2.00
NO RESPONSE or NIL	0	0	0	0.00
MEAN S.D.	100.00 0.00	22.66 29.62	77.34 29.62	

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Informal settlements

	TOTAL	APPLIANCE USED... yes	no	MEAN
Pots and pans ever	83 100.00	83 100.00	0 0.00	1.00
Pots and pans now	83 100.00	83 100.00	0 0.00	1.00
Elec kettle ever	83 100.00	18 21.69	65 78.31	1.78
Elec kettle now	83 100.00	17 20.48	66 79.52	1.80
Coffee maker ever	83 100.00	0 0.00	83 100.00	2.00
Coffee maker now	83 100.00	0 0.00	83 100.00	2.00
Steam iron ever	83 100.00	13 15.66	70 84.34	1.84
Steam iron now	83 100.00	11 13.25	72 86.75	1.87
Other iron ever	83 100.00	51 61.45	32 38.55	1.39
Other iron now	83 100.00	50 60.24	33 39.76	1.40
Auto washing machine ever	83 100.00	0 0.00	83 100.00	2.00
Auto washing machine now	83 100.00	0 0.00	83 100.00	2.00
Fridge ever	83 100.00	17 20.48	66 79.52	1.80
Fridge now	83 100.00	16 19.28	67 80.72	1.81

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Informal settlements

		APPLIANCE USED...		
	TOTAL	yes	no	MEAN
Elec dishwasher ever	83 100.00	0 0.00	83 100.00	2.00
Elec dishwasher now	83 100.00	0 0.00	83 100.00	2.00
Soda stream ever	83 100.00	0 0.00	83 100.00	2.00
Soda stream now	83 100.00	0 0.00	83 100.00	2.00
Other wash machine ever	83 100.00	0 0.00	83 100.00	2.00
Other wash machine now	83 100.00	0 0.00	83 100.00	2.00
NO RESPONSE or NIL	0	0	0	0.00
MEAN	100.00	21.63	78.37	
S.D.	0.00	32.57	32.57	

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Suburban

		APPLIANCE USED...		
	TOTAL	yes	no	MEAN
Pots and pans ever	137 100.00	137 100.00	0 0.00	1.00
Pots and pans now	137 100.00	137 100.00	0 0.00	1.00
Elec kettle ever	137 100.00	135 98.54	2 1.46	1.01
Elec kettle now	137 100.00	135 98.54	2 1.46	1.01
Coffee maker ever	137 100.00	26 18.98	111 81.02	1.81
Coffee maker now	137 100.00	17 12.41	120 87.59	1.88
Steam iron ever	137 100.00	109 79.56	28 20.44	1.20
Steam iron now	137 100.00	104 75.91	33 24.09	1.24
Other iron ever	137 100.00	38 27.74	99 72.26	1.72
Other iron now	137 100.00	37 27.01	100 72.99	1.73
Auto washing machine ever	137 100.00	59 43.07	78 56.93	1.57
Auto washing machine now	137 100.00	58 42.34	79 57.66	1.58
Fridge ever	137 100.00	135 98.54	2 1.46	1.01
Fridge now	137 100.00	135 98.54	2 1.46	1.01

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Suburban

		APPLIANCE USED...		
	TOTAL	yes	no	MEAN
Elec dishwasher ever	137 100.00	17 12.41	120 87.59	1.88
Elec dishwasher now	137 100.00	17 12.41	120 87.59	1.88
Soda stream ever	137 100.00	43 31.39	94 68.61	1.69
Soda stream now	137 100.00	33 24.09	104 75.91	1.76
Other wash machine ever	137 100.00	39 28.47	98 71.53	1.72
Other wash machine now	137 100.00	38 27.74	99 72.26	1.72
NO RESPONSE or NIL	0	0	0	0.00
MEAN S.D.	100.00 0.00	52.88 35.62	47.12 35.63	

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Township

	TOTAL	APPLIANCE USED... yes	no	MEAN
Pots and pans ever	128 100.00	127 99.22	1 0.78	1.01
Pots and pans now	128 100.00	127 99.22	1 0.78	1.01
Elec kettle ever	128 100.00	96 75.00	32 25.00	1.25
Elec kettle now	128 100.00	93 72.66	35 27.34	1.27
Coffee maker ever	128 100.00	4 3.13	124 96.88	1.97
Coffee maker now	128 100.00	2 1.56	126 98.44	1.98
Steam iron ever	128 100.00	77 60.16	51 39.84	1.40
Steam iron now	128 100.00	68 53.13	60 46.88	1.47
Other iron ever	128 100.00	61 47.66	67 52.34	1.52
Other iron now	128 100.00	58 45.31	70 54.69	1.55
Auto washing machine ever	128 100.00	17 13.28	111 86.72	1.87
Auto washing machine now	128 100.00	17 13.28	111 86.72	1.87
Fridge ever	128 100.00	85 66.41	43 33.59	1.34
Fridge now	128 100.00	78 60.94	50 39.06	1.39

WRC Klerksdorp Water Salinity Survey

TABLE 6: Appliances

Township

		APPLIANCE USED...		
	TOTAL	yes	no	MEAN
Elec dishwasher ever	128 100.00	0 0.00	128 100.00	2.00
Elec dishwasher now	128 100.00	0 0.00	128 100.00	2.00
Soda stream ever	128 100.00	3 2.34	125 97.66	1.98
Soda stream now	128 100.00	2 1.56	126 98.44	1.98
Other wash machine ever	128 100.00	5 3.91	123 96.09	1.96
Other wash machine now	128 100.00	5 3.91	123 96.09	1.96
NO RESPONSE or NIL	0	0	0	0.00
MEAN	100.00	36.13	63.87	
S.D.	0.00	35.37	35.37	

TABLE 7: Appliances continued

Informal settlements

	TOTAL	APPLIANCE USED... yes	no	MEAN
Drinking water filtr ever	83 100.00	0 0.00	83 100.00	2.00
Drinking water filtr now	83 100.00	0 0.00	83 100.00	2.00
Humidifier ever	83 100.00	0 0.00	83 100.00	2.00
Humidifier now	83 100.00	0 0.00	83 100.00	2.00
Fish tank filter ever	83 100.00	0 0.00	83 100.00	2.00
Fish tank filter now	83 100.00	0 0.00	83 100.00	2.00
MEAN	100.00	0.00	100.00	
S.D.	0.00	0.00	0.00	

TABLE 8: Laundry bar soap

Itchy skin attributed to water

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	55	36	12	7	45	10	41	14	23	23	9
Sunlight	29	27	1	1	28	1	28	1	12	14	3
	76.32	93.10	14.29	50.00	82.35	25.00	90.32	14.29	75.00	82.35	60.00
		93.10	3.45	3.45	96.55	3.45	96.55	3.45	41.38	48.28	10.34
Viva	4	2	2	0	3	1	2	2	3	1	0
	10.53	6.90	28.57	0.00	8.82	25.00	6.45	28.57	18.75	5.88	0.00
		50.00	50.00	0.00	75.00	25.00	50.00	50.00	75.00	25.00	0.00
On sale	3	0	2	1	2	1	1	2	1	0	2
	7.89	0.00	28.57	50.00	5.88	25.00	3.23	28.57	6.25	0.00	40.00
		0.00	66.67	33.33	66.67	33.33	33.33	66.67	33.33	0.00	66.67
Geisha	1	0	1	0	1	0	0	1	0	1	0
	2.63	0.00	14.29	0.00	2.94	0.00	0.00	14.29	0.00	5.88	0.00
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00
Blue soap	1	0	1	0	0	1	0	1	0	1	0
	2.63	0.00	14.29	0.00	0.00	25.00	0.00	14.29	0.00	5.88	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
NO RESPONSE or NIL	17	7	5	5	11	6	10	7	7	6	4
MEAN	9.2	1.2	30.7	50.0	7.1	27.3	4.4	30.7	7.7	1.5	40.2
S.D.	26.7	0.8	46.7	69.3	23.3	47.9	17.6	46.7	24.4	1.2	53.7
Chi Square		26.95			12.71		20.48		12.56		
		p=.001			p=.013		p=.001		p=.128		

WRC Klerksdorp Water Salinity Survey

TABLE 9: Laundry detergent

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Omo	153	58	55	40	88	65	70	83	45	63	45
	44.35	43.28	42.97	48.19	42.72	46.76	41.42	47.16	43.69	45.32	43.69
		37.91	35.95	26.14	57.52	42.48	45.75	54.25	29.41	41.18	29.41
Surf	54	10	25	19	22	32	16	38	16	18	20
	15.65	7.46	19.53	22.89	10.68	23.02	9.47	21.59	15.53	12.95	19.42
		18.52	46.30	35.19	40.74	59.26	29.63	70.37	29.63	33.33	37.04
Omo micro	46	5	25	16	20	26	14	32	8	22	16
	13.33	3.73	19.53	19.28	9.71	18.71	8.28	18.18	7.77	15.83	15.53
		10.87	54.35	34.78	43.48	56.52	30.43	69.57	17.39	47.83	34.78
Skip	21	17	4	0	20	1	16	5	7	9	5
	6.09	12.69	3.13	0.00	9.71	0.72	9.47	2.84	6.80	6.47	4.85
		80.95	19.05	0.00	95.24	4.76	76.19	23.81	33.33	42.86	23.81
On sale	18	7	7	4	11	7	11	7	3	7	8
	5.22	5.22	5.47	4.82	5.34	5.04	6.51	3.98	2.91	5.04	7.77
		38.89	38.89	22.22	61.11	38.89	61.11	38.89	16.67	38.89	44.44
Surf Micro	10	0	8	2	6	4	3	7	4	2	4
	2.90	0.00	6.25	2.41	2.91	2.88	1.78	3.98	3.88	1.44	3.88
		0.00	80.00	20.00	60.00	40.00	30.00	70.00	40.00	20.00	40.00
Punch	8	7	0	1	7	1	6	2	5	3	0
	2.32	5.22	0.00	1.20	3.40	0.72	3.55	1.14	4.85	2.16	0.00
		87.50	0.00	12.50	87.50	12.50	75.00	25.00	62.50	37.50	0.00
Dynamo	8	8	0	0	8	0	8	0	4	4	0
	2.32	5.97	0.00	0.00	3.88	0.00	4.73	0.00	3.88	2.88	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Bio Classic	5	5	0	0	5	0	5	0	3	2	0
	1.45	3.73	0.00	0.00	2.43	0.00	2.96	0.00	2.91	1.44	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	60.00	40.00	0.00
No name brand	3	2	1	0	2	1	2	1	0	1	2
	0.87	1.49	0.78	0.00	0.97	0.72	1.18	0.57	0.00	0.72	1.94
		66.67	33.33	0.00	66.67	33.33	66.67	33.33	0.00	33.33	66.67
Surf and Omo	3	0	2	1	1	2	2	1	0	2	1
	0.87	0.00	1.56	1.20	0.49	1.44	1.18	0.57	0.00	1.44	0.97
		0.00	66.67	33.33	33.33	66.67	66.67	33.33	0.00	66.67	33.33

TABLE 9: Laundry detergent

	TOTAL	AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
		SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Sunlight	3	3	0	0	3	0	3	0	2	1	0
	0.87	2.24	0.00	0.00	1.46	0.00	1.78	0.00	1.94	0.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00
Bio Tex	3	3	0	0	3	0	3	0	1	2	0
	0.87	2.24	0.00	0.00	1.46	0.00	1.78	0.00	0.97	1.44	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
Woolworths	2	2	0	0	2	0	2	0	1	0	1
	0.58	1.49	0.00	0.00	0.97	0.00	1.18	0.00	0.97	0.00	0.97
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	0.00	50.00
Bingo	2	2	0	0	2	0	2	0	0	2	0
	0.58	1.49	0.00	0.00	0.97	0.00	1.18	0.00	0.00	1.44	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Skip Omo and Jik colours	2	2	0	0	2	0	2	0	1	0	1
	0.58	1.49	0.00	0.00	0.97	0.00	1.18	0.00	0.97	0.00	0.97
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	0.00	50.00
Any	1	0	1	0	1	0	1	0	0	1	0
	0.29	0.00	0.78	0.00	0.49	0.00	0.59	0.00	0.00	0.72	0.00
		0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Omom and Dynamo	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.75	0.00	0.00	0.49	0.00	0.59	0.00	0.97	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Good Clean and Fresh	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.75	0.00	0.00	0.49	0.00	0.59	0.00	0.97	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.75	0.00	0.00	0.49	0.00	0.59	0.00	0.97	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	3	3	0	0	3	0	3	0	3	0	0
MEAN	9.8	11.6	8.9	8.1	10.8	8.3	12.2	7.4	8.5	9.6	11.3
S.D.	21.2	21.1	21.8	20.6	21.4	21.0	23.3	18.7	16.3	20.9	25.7
Chi Square		108.09			47.52		56.91		43.05		
		p=.001			p=.001		p=.001		p=.264		

TABLE 10: Bath bar soap

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Lux	143	56	53	34	87	56	71	72	42	58	43
	41.45	41.18	42.06	40.96	41.63	41.18	41.76	41.14	39.62	42.34	42.16
		39.16	37.06	23.78	60.84	39.16	49.65	50.35	29.37	40.56	30.07
No name brand	79	10	42	27	39	40	25	54	18	32	29
	22.90	7.35	33.33	32.53	18.66	29.41	14.71	30.86	16.98	23.36	28.43
		12.66	53.16	34.18	49.37	50.63	31.65	68.35	22.78	40.51	36.71
Palmolive	28	19	6	3	20	8	21	7	12	11	5
	8.12	13.97	4.76	3.61	9.57	5.88	12.35	4.00	11.32	8.03	4.90
		67.86	21.43	10.71	71.43	28.57	75.00	25.00	42.86	39.29	17.86
On sale	23	16	3	4	17	6	15	8	12	6	5
	6.67	11.76	2.38	4.82	8.13	4.41	8.82	4.57	11.32	4.38	4.90
		69.57	13.04	17.39	73.91	26.09	65.22	34.78	52.17	26.09	21.74
SilkE	15	12	3	0	14	1	13	2	3	7	5
	4.35	8.82	2.38	0.00	6.70	0.74	7.65	1.14	2.83	5.11	4.90
		80.00	20.00	0.00	93.33	6.67	86.67	13.33	20.00	46.67	33.33
Life buoy	9	0	5	4	2	7	1	8	2	4	3
	2.61	0.00	3.97	4.82	0.96	5.15	0.59	4.57	1.89	2.92	2.94
		0.00	55.56	44.44	22.22	77.78	11.11	88.89	22.22	44.44	33.33
Dove	8	7	0	1	7	1	7	1	6	2	0
	2.32	5.15	0.00	1.20	3.35	0.74	4.12	0.57	5.66	1.46	0.00
		87.50	0.00	12.50	87.50	12.50	87.50	12.50	75.00	25.00	0.00
Geisha	6	0	5	1	2	4	1	5	0	1	5
	1.74	0.00	3.97	1.20	0.96	2.94	0.59	2.86	0.00	0.73	4.90
		0.00	83.33	16.67	33.33	66.67	16.67	83.33	0.00	16.67	83.33
Breeze	6	1	2	3	2	4	1	5	2	2	2
	1.74	0.74	1.59	3.61	0.96	2.94	0.59	2.86	1.89	1.46	1.96
		16.67	33.33	50.00	33.33	66.67	16.67	83.33	33.33	33.33	33.33
Any	6	1	4	1	3	3	1	5	1	3	2
	1.74	0.74	3.17	1.20	1.44	2.21	0.59	2.86	0.94	2.19	1.96
		16.67	66.67	16.67	50.00	50.00	16.67	83.33	16.67	50.00	33.33
Sunlight bath	5	1	3	1	3	2	2	3	1	3	1
	1.45	0.74	2.38	1.20	1.44	1.47	1.18	1.71	0.94	2.19	0.98
		20.00	60.00	20.00	60.00	40.00	40.00	60.00	20.00	60.00	20.00

TABLE 10: Bath bar soap

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Choice	4	0	0	4	0	4	0	4	1	2	1
	1.16	0.00	0.00	4.82	0.00	2.94	0.00	2.29	0.94	1.46	0.98
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	25.00	50.00	25.00
No name brand	3	3	0	0	3	0	3	0	0	2	1
	0.87	2.21	0.00	0.00	1.44	0.00	1.76	0.00	0.00	1.46	0.98
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	66.67	33.33
Vinolia	3	3	0	0	3	0	2	1	1	2	0
	0.87	2.21	0.00	0.00	1.44	0.00	1.18	0.57	0.94	1.46	0.00
		100.00	0.00	0.00	100.00	0.00	66.67	33.33	33.33	66.67	0.00
Lux and Palmolive	2	2	0	0	2	0	2	0	2	0	0
	0.58	1.47	0.00	0.00	0.96	0.00	1.18	0.00	1.89	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Cuticura	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.74	0.00	0.00	0.48	0.00	0.59	0.00	0.94	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
SilkE and Palm Olive	1	1	0	0	1	0	1	0	0	1	0
	0.29	0.74	0.00	0.00	0.48	0.00	0.59	0.00	0.00	0.73	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Lux Palm Olive and Pears	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.74	0.00	0.00	0.48	0.00	0.59	0.00	0.94	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Glycerine	1	1	0	0	1	0	1	0	1	0	0
	0.29	0.74	0.00	0.00	0.48	0.00	0.59	0.00	0.94	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Colgate	1	1	0	0	1	0	1	0	0	1	0
	0.29	0.74	0.00	0.00	0.48	0.00	0.59	0.00	0.00	0.73	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
NO RESPONSE or NIL	3	1	2	0	0	3	2	1	0	2	1
MEAN	10.3	16.4	5.2	7.9	12.0	7.6	12.9	7.7	15.2	8.1	7.9
S.D.	24.0	30.5	14.8	20.8	26.2	19.9	27.1	20.2	30.3	19.8	20.9
Chi Square		112.41			40.59		60.27		47.25		
		p=.001			p=.003		p=.001		p=.144		

TABLE 11: Other Bath soap

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Sunlight	15	1	6	8	4	11	3	12	1	8	6
	22.39	8.33	17.14	40.00	11.76	33.33	12.00	28.57	7.69	28.57	23.08
		6.67	40.00	53.33	26.67	73.33	20.00	80.00	6.67	53.33	40.00
Palmolive	11	0	9	2	8	3	6	5	0	4	7
	16.42	0.00	25.71	10.00	23.53	9.09	24.00	11.90	0.00	14.29	26.92
		0.00	81.82	18.18	72.73	27.27	54.55	45.45	0.00	36.36	63.64
Lux	10	1	7	2	5	5	4	6	3	3	4
	14.93	8.33	20.00	10.00	14.71	15.15	16.00	14.29	23.08	10.71	15.38
		10.00	70.00	20.00	50.00	50.00	40.00	60.00	30.00	30.00	40.00
On sale	8	2	3	3	4	4	3	5	4	3	1
	11.94	16.67	8.57	15.00	11.76	12.12	12.00	11.90	30.77	10.71	3.85
		25.00	37.50	37.50	50.00	50.00	37.50	62.50	50.00	37.50	12.50
Breeze	6	0	4	2	2	4	1	5	1	3	2
	8.96	0.00	11.43	10.00	5.88	12.12	4.00	11.90	7.69	10.71	7.69
		0.00	66.67	33.33	33.33	66.67	16.67	83.33	16.67	50.00	33.33
Dove	5	4	1	0	5	0	5	0	1	3	1
	7.46	33.33	2.86	0.00	14.71	0.00	20.00	0.00	7.69	10.71	3.85
		80.00	20.00	0.00	100.00	0.00	100.00	0.00	20.00	60.00	20.00
Life Buoy	3	0	0	3	0	3	0	3	1	1	1
	4.48	0.00	0.00	15.00	0.00	9.09	0.00	7.14	7.69	3.57	3.85
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	33.33	33.33	33.33
Geisha	2	0	2	0	2	0	0	2	0	2	0
	2.99	0.00	5.71	0.00	5.88	0.00	0.00	4.76	0.00	7.14	0.00
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00
Baby soap	2	2	0	0	2	0	2	0	0	1	1
	2.99	16.67	0.00	0.00	5.88	0.00	8.00	0.00	0.00	3.57	3.85
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	50.00	50.00
SilkE	1	0	1	0	0	1	0	1	0	0	1
	1.49	0.00	2.86	0.00	0.00	3.03	0.00	2.38	0.00	0.00	3.85
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
Viva	1	0	1	0	0	1	0	1	0	0	1
	1.49	0.00	2.86	0.00	0.00	3.03	0.00	2.38	0.00	0.00	3.85
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00

TABLE 11: Other Bath soap

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Blue soap	1	0	1	0	0	1	0	1	0	0	1
	1.49	0.00	2.86	0.00	0.00	3.03	0.00	2.38	0.00	0.00	3.85
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
Perfumed	1	1	0	0	1	0	0	1	1	0	0
	1.49	8.33	0.00	0.00	2.94	0.00	0.00	2.38	7.69	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	0.00	100.00	100.00	0.00	0.00
Golden Products	1	1	0	0	1	0	1	0	1	0	0
	1.49	8.33	0.00	0.00	2.94	0.00	4.00	0.00	7.69	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	281	125	93	63	175	106	147	134	93	111	77
MEAN	16.7	23.3	12.2	20.8	16.1	17.4	16.4	17.0	34.9	15.8	8.7
S.D.	30.7	35.5	27.1	33.9	30.9	30.9	31.3	30.7	44.6	29.5	18.7
Chi Square		55.11			23.20		23.24		29.64		
		p=.001			p=.039		p=.039		p=.283		

TABLE 12: Shampoos

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Colgate	43	26	13	4	33	10	28	15	11	19	13
	24.43	18.98	46.43	36.36	21.85	40.00	19.58	45.45	14.67	26.76	43.33
		60.47	30.23	9.30	76.74	23.26	65.12	34.88	25.58	44.19	30.23
On sale	15	12	2	1	12	3	13	2	7	7	1
	8.52	8.76	7.14	9.09	7.95	12.00	9.09	6.06	9.33	9.86	3.33
		80.00	13.33	6.67	80.00	20.00	86.67	13.33	46.67	46.67	6.67
Gliss	8	8	0	0	8	0	8	0	5	3	0
	4.55	5.84	0.00	0.00	5.30	0.00	5.59	0.00	6.67	4.23	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	62.50	37.50	0.00
Salon Selective	6	5	1	0	5	1	5	1	3	3	0
	3.41	3.65	3.57	0.00	3.31	4.00	3.50	3.03	4.00	4.23	0.00
		83.33	16.67	0.00	83.33	16.67	83.33	16.67	50.00	50.00	0.00
Soft'n Free	6	0	3	3	2	4	0	6	3	2	1
	3.41	0.00	10.71	27.27	1.32	16.00	0.00	18.18	4.00	2.82	3.33
		0.00	50.00	50.00	33.33	66.67	0.00	100.00	50.00	33.33	16.67
Vibrance	6	6	0	0	6	0	6	0	2	4	0
	3.41	4.38	0.00	0.00	3.97	0.00	4.20	0.00	2.67	5.63	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
Revlon	5	4	1	0	5	0	5	0	1	2	2
	2.84	2.92	3.57	0.00	3.31	0.00	3.50	0.00	1.33	2.82	6.67
		80.00	20.00	0.00	100.00	0.00	100.00	0.00	20.00	40.00	40.00
Dimensions	5	5	0	0	5	0	5	0	3	2	0
	2.84	3.65	0.00	0.00	3.31	0.00	3.50	0.00	4.00	2.82	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	60.00	40.00	0.00
Flex	5	5	0	0	5	0	5	0	1	4	0
	2.84	3.65	0.00	0.00	3.31	0.00	3.50	0.00	1.33	5.63	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	20.00	80.00	0.00
Protein feed	5	5	0	0	5	0	5	0	3	2	0
	2.84	3.65	0.00	0.00	3.31	0.00	3.50	0.00	4.00	2.82	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	60.00	40.00	0.00
Organics	5	5	0	0	4	1	5	0	1	4	0
	2.84	3.65	0.00	0.00	2.65	4.00	3.50	0.00	1.33	5.63	0.00
		100.00	0.00	0.00	80.00	20.00	100.00	0.00	20.00	80.00	0.00

TABLE 12: Shampoos

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Palmolive	4	4	0	0	4	0	4	0	3	0	1
	2.27	2.92	0.00	0.00	2.65	0.00	2.80	0.00	4.00	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	75.00	0.00	25.00
VO 5	4	4	0	0	4	0	4	0	2	1	1
	2.27	2.92	0.00	0.00	2.65	0.00	2.80	0.00	2.67	1.41	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	25.00	25.00
Timotei	4	4	0	0	4	0	4	0	3	0	1
	2.27	2.92	0.00	0.00	2.65	0.00	2.80	0.00	4.00	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	75.00	0.00	25.00
Ordinary	3	0	2	1	2	1	2	1	0	1	2
	1.70	0.00	7.14	9.09	1.32	4.00	1.40	3.03	0.00	1.41	6.67
		0.00	66.67	33.33	66.67	33.33	66.67	33.33	0.00	33.33	66.67
Glyco Lemon	3	2	1	0	2	1	2	1	1	1	1
	1.70	1.46	3.57	0.00	1.32	4.00	1.40	3.03	1.33	1.41	3.33
		66.67	33.33	0.00	66.67	33.33	66.67	33.33	33.33	33.33	33.33
Silkience	3	3	0	0	3	0	3	0	1	2	0
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	1.33	2.82	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
Denorex	3	3	0	0	3	0	3	0	2	1	0
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	2.67	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00
Jane Seymour	3	3	0	0	3	0	3	0	2	0	1
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	2.67	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	0.00	33.33
Finesse	3	3	0	0	3	0	3	0	2	1	0
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	2.67	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00
Gill	3	3	0	0	3	0	2	1	2	0	1
	1.70	2.19	0.00	0.00	1.99	0.00	1.40	3.03	2.67	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	66.67	33.33	66.67	0.00	33.33
Johnsons	3	3	0	0	3	0	3	0	2	1	0
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	2.67	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00

TABLE 12: Shampoos

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Alberto	3	3	0	0	3	0	3	0	2	0	1
	1.70	2.19	0.00	0.00	1.99	0.00	2.10	0.00	2.67	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	0.00	33.33
Sunlight	2	1	1	0	2	0	2	0	1	1	0
	1.14	0.73	3.57	0.00	1.32	0.00	1.40	0.00	1.33	1.41	0.00
		50.00	50.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Anyeze	2	0	1	1	0	2	0	2	1	1	0
	1.14	0.00	3.57	9.09	0.00	8.00	0.00	6.06	1.33	1.41	0.00
		0.00	50.00	50.00	0.00	100.00	0.00	100.00	50.00	50.00	0.00
Magic Style	2	1	1	0	1	1	1	1	0	2	0
	1.14	0.73	3.57	0.00	0.66	4.00	0.70	3.03	0.00	2.82	0.00
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	0.00	100.00	0.00
Super Care	2	1	0	1	1	1	1	1	1	0	1
	1.14	0.73	0.00	9.09	0.66	4.00	0.70	3.03	1.33	0.00	3.33
		50.00	0.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00	50.00
Black like me	2	0	2	0	2	0	1	1	1	0	1
	1.14	0.00	7.14	0.00	1.32	0.00	0.70	3.03	1.33	0.00	3.33
		0.00	100.00	0.00	100.00	0.00	50.00	50.00	50.00	0.00	50.00
Intensive Care	2	2	0	0	2	0	2	0	0	2	0
	1.14	1.46	0.00	0.00	1.32	0.00	1.40	0.00	0.00	2.82	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Body on Tap	2	2	0	0	2	0	1	1	1	1	0
	1.14	1.46	0.00	0.00	1.32	0.00	0.70	3.03	1.33	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	50.00	50.00	50.00	50.00	0.00
Prescription	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Pears	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Flex and Colgate	1	1	0	0	1	0	1	0	0	1	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00

TABLE 12: *Shampoos*

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Mother of Pearl	1	1	0	0	1	0	1	0	0	0	1
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
Palet	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Oreal	1	1	0	0	1	0	1	0	0	0	1
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
Harpers	1	1	0	0	1	0	1	0	0	1	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Alkod	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Optons	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Aqua marine	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Tresem	1	1	0	0	1	0	1	0	0	1	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Dimension & Colgate	1	1	0	0	1	0	1	0	0	1	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	0.00	1.41	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Design	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.57	0.73	0.00	0.00	0.66	0.00	0.70	0.00	1.33	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 12: *Shampoos*

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
NO RESPONSE or NIL	172	0	100	72	58	114	29	143	31	68	73
MEAN	21.7	24.7	10.6	13.2	22.6	16.6	24.0	11.7	25.3	21.8	12.5
S.D.	26.5	26.1	25.2	28.6	25.6	31.7	26.6	24.0	26.7	28.2	19.8
Chi Square		101.77 p=.118			49.84 p=.220		68.78 p=.008		85.81 p=.486		

TABLE 13: Cold drinks

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Carbonated	170	52	67	51	92	78	72	98	45	65	60
	55.19	45.22	57.76	66.23	50.83	61.42	48.65	61.25	50.56	51.59	64.52
		30.59	39.41	30.00	54.12	45.88	42.35	57.65	26.47	38.24	35.29
Oros	53	15	24	14	28	25	21	32	11	23	19
	17.21	13.04	20.69	18.18	15.47	19.69	14.19	20.00	12.36	18.25	20.43
		28.30	45.28	26.42	52.83	47.17	39.62	60.38	20.75	43.40	35.85
Sweeto	20	13	5	2	14	6	13	7	4	13	3
	6.49	11.30	4.31	2.60	7.73	4.72	8.78	4.38	4.49	10.32	3.23
		65.00	25.00	10.00	70.00	30.00	65.00	35.00	20.00	65.00	15.00
Tea/Coffee	19	10	7	2	16	3	14	5	9	7	3
	6.17	8.70	6.03	2.60	8.84	2.36	9.46	3.13	10.11	5.56	3.23
		52.63	36.84	10.53	84.21	15.79	73.68	26.32	47.37	36.84	15.79
Juice	17	9	7	1	14	3	12	5	6	9	2
	5.52	7.83	6.03	1.30	7.73	2.36	8.11	3.13	6.74	7.14	2.15
		52.94	41.18	5.88	82.35	17.65	70.59	29.41	35.29	52.94	11.76
Super 7	8	8	0	0	7	1	7	1	4	3	1
	2.60	6.96	0.00	0.00	3.87	0.79	4.73	0.63	4.49	2.38	1.08
		100.00	0.00	0.00	87.50	12.50	87.50	12.50	50.00	37.50	12.50
Any	7	0	5	2	1	6	1	6	3	2	2
	2.27	0.00	4.31	2.60	0.55	4.72	0.68	3.75	3.37	1.59	2.15
		0.00	71.43	28.57	14.29	85.71	14.29	85.71	42.86	28.57	28.57
On sale	6	3	1	2	4	2	3	3	4	2	0
	1.95	2.61	0.86	2.60	2.21	1.57	2.03	1.88	4.49	1.59	0.00
		50.00	16.67	33.33	66.67	33.33	50.00	50.00	66.67	33.33	0.00
Foro	3	0	0	3	0	3	0	3	1	0	2
	0.97	0.00	0.00	3.90	0.00	2.36	0.00	1.88	1.12	0.00	2.15
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	33.33	0.00	66.67
Halls	3	3	0	0	3	0	3	0	2	1	0
	0.97	2.61	0.00	0.00	1.66	0.00	2.03	0.00	2.25	0.79	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00
Lotus	1	1	0	0	1	0	1	0	0	0	1
	0.32	0.87	0.00	0.00	0.55	0.00	0.68	0.00	0.00	0.00	1.08
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00

TABLE 13: Cold drinks

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Kool Aid	1	1	0	0	1	0	1	0	0	1	0
	0.32	0.87	0.00	0.00	0.55	0.00	0.68	0.00	0.00	0.79	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
NO RESPONSE or NIL	40	22	12	6	28	12	24	16	17	13	10
MEAN	5.4	6.4	4.1	5.9	5.7	5.1	5.6	5.3	7.9	5.1	3.5
S.D.	13.3	15.4	9.0	15.3	14.2	12.0	13.7	13.1	20.0	12.1	1.4
Chi Square		55.83			28.69		30.86		31.70		
		p=.001			p=.003		p=.001		p=.083		

TABLE 14: Bottled water

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Schoonspruit	5	5	0	0	5	0	5	0	2	3	0
	62.50	62.50	0.00	0.00	62.50	0.00	62.50	0.00	50.00	75.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	40.00	60.00	0.00
On sale	2	2	0	0	2	0	2	0	1	1	0
	25.00	25.00	0.00	0.00	25.00	0.00	25.00	0.00	25.00	25.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Cape Clear	1	1	0	0	1	0	1	0	1	0	0
	12.50	12.50	0.00	0.00	12.50	0.00	12.50	0.00	25.00	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	340	129	128	83	201	139	164	176	102	135	103
MEAN	26.1	26.1	0.0	0.0	26.1	0.0	26.1	0.0	26.0	26.3	0.0
S.D.	45.0	45.0	0.0	0.0	45.0	0.0	45.0	0.0	48.7	48.5	0.0
Chi Square		*0.00*			*0.00*		*0.00*		1.20		
		p=.999			p=.999		p=.999		p=.878		

TABLE 15: Fabric Softener

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Sta-Soft	201	91	74	36	131	70	113	88	59	88	54
	67.68	70.00	66.07	65.45	67.18	68.63	68.48	66.67	64.84	70.40	66.67
		45.27	36.82	17.91	65.17	34.83	56.22	43.78	29.35	43.78	26.87
Sunlight	39	17	15	7	29	10	23	16	9	16	14
	13.13	13.08	13.39	12.73	14.87	9.80	13.94	12.12	9.89	12.80	17.28
		43.59	38.46	17.95	74.36	25.64	58.97	41.03	23.08	41.03	35.90
No Name	15	2	9	4	6	9	3	12	3	5	7
	5.05	1.54	8.04	7.27	3.08	8.82	1.82	9.09	3.30	4.00	8.64
		13.33	60.00	26.67	40.00	60.00	20.00	80.00	20.00	33.33	46.67
On sale	12	8	3	1	10	2	11	1	6	3	3
	4.04	6.15	2.68	1.82	5.13	1.96	6.67	0.76	6.59	2.40	3.70
		66.67	25.00	8.33	83.33	16.67	91.67	8.33	50.00	25.00	25.00
Country Pride	8	5	2	1	5	3	4	4	4	3	1
	2.69	3.85	1.79	1.82	2.56	2.94	2.42	3.03	4.40	2.40	1.23
		62.50	25.00	12.50	62.50	37.50	50.00	50.00	50.00	37.50	12.50
Green Apple	5	0	3	2	3	2	1	4	3	2	0
	1.68	0.00	2.68	3.64	1.54	1.96	0.61	3.03	3.30	1.60	0.00
		0.00	60.00	40.00	60.00	40.00	20.00	80.00	60.00	40.00	0.00
Ordinary	4	0	3	1	2	2	2	2	2	2	0
	1.35	0.00	2.68	1.82	1.03	1.96	1.21	1.52	2.20	1.60	0.00
		0.00	75.00	25.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
Yellow Blend	3	0	2	1	1	2	1	2	1	1	1
	1.01	0.00	1.79	1.82	0.51	1.96	0.61	1.52	1.10	0.80	1.23
		0.00	66.67	33.33	33.33	66.67	33.33	66.67	33.33	33.33	33.33
Any	3	1	1	1	2	1	1	2	2	1	0
	1.01	0.77	0.89	1.82	1.03	0.98	0.61	1.52	2.20	0.80	0.00
		33.33	33.33	33.33	66.67	33.33	33.33	66.67	66.67	33.33	0.00
NJ Chemicals	2	2	0	0	2	0	2	0	0	2	0
	0.67	1.54	0.00	0.00	1.03	0.00	1.21	0.00	0.00	1.60	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Baby Soft	1	1	0	0	1	0	1	0	1	0	0
	0.34	0.77	0.00	0.00	0.51	0.00	0.61	0.00	1.10	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 15: Fabric Softener

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Chembrite	1	1	0	0	1	0	1	0	0	1	0
	0.34	0.77	0.00	0.00	0.51	0.00	0.61	0.00	0.00	0.80	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Comfort	1	1	0	0	1	0	1	0	0	1	0
	0.34	0.77	0.00	0.00	0.51	0.00	0.61	0.00	0.00	0.80	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.34	0.77	0.00	0.00	0.51	0.00	0.61	0.00	1.10	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
30	1	0	0	1	0	1	0	1	0	0	1
	0.34	0.00	0.00	1.82	0.00	0.98	0.00	0.76	0.00	0.00	1.23
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
NO RESPONSE or NIL	51	7	16	28	14	37	7	44	15	14	22
MEAN	7.3	9.4	5.9	5.6	8.3	5.6	9.7	4.4	9.8	5.7	7.1
S.D.	19.0	23.1	15.6	13.4	21.2	13.6	24.0	8.7	23.9	14.8	18.4
Chi Square		31.95			14.36		24.20		28.30		
		p=.277			p=.424		p=.043		p=.449		

TABLE 16: Fabric bleach

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Jik	186	93	63	30	130	56	107	79	59	81	46
	83.04	86.92	78.75	81.08	84.42	80.00	84.25	81.44	83.10	88.04	75.41
		50.00	33.87	16.13	69.89	30.11	57.53	42.47	31.72	43.55	24.73
ACE	17	6	9	2	13	4	8	9	5	3	9
	7.59	5.61	11.25	5.41	8.44	5.71	6.30	9.28	7.04	3.26	14.75
		35.29	52.94	11.76	76.47	23.53	47.06	52.94	29.41	17.65	52.94
No name brand	7	1	4	2	3	4	3	4	2	2	3
	3.13	0.93	5.00	5.41	1.95	5.71	2.36	4.12	2.82	2.17	4.92
		14.29	57.14	28.57	42.86	57.14	42.86	57.14	28.57	28.57	42.86
On sale	4	3	0	1	2	2	3	1	2	2	0
	1.79	2.80	0.00	2.70	1.30	2.86	2.36	1.03	2.82	2.17	0.00
		75.00	0.00	25.00	50.00	50.00	75.00	25.00	50.00	50.00	0.00
Ordinary	2	0	1	1	1	1	1	1	0	1	1
	0.89	0.00	1.25	2.70	0.65	1.43	0.79	1.03	0.00	1.09	1.64
		0.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00	50.00	50.00
Ajax	2	1	1	0	2	0	2	0	0	2	0
	0.89	0.93	1.25	0.00	1.30	0.00	1.57	0.00	0.00	2.17	0.00
		50.00	50.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Domestos	2	1	1	0	1	1	1	1	1	0	1
	0.89	0.93	1.25	0.00	0.65	1.43	0.79	1.03	1.41	0.00	1.64
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	50.00	0.00	50.00
Javelle	1	0	0	1	0	1	0	1	0	0	1
	0.45	0.00	0.00	2.70	0.00	1.43	0.00	1.03	0.00	0.00	1.64
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
Any	1	0	1	0	0	1	0	1	0	1	0
	0.45	0.00	1.25	0.00	0.00	1.43	0.00	1.03	0.00	1.09	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
Jik All Colours	1	1	0	0	1	0	1	0	1	0	0
	0.45	0.93	0.00	0.00	0.65	0.00	0.79	0.00	1.41	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make Own	1	1	0	0	1	0	1	0	1	0	0
	0.45	0.93	0.00	0.00	0.65	0.00	0.79	0.00	1.41	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 16: Fabric bleach

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
NO RESPONSE or NIL	124	30	48	46	55	69	45	79	35	47	42
MEAN	3.2	4.1	1.5	4.1	2.6	4.4	3.7	2.5	4.3	3.4	1.6
S.D.	13.0	16.3	1.4	16.1	11.2	16.4	14.9	10.0	16.3	14.4	1.4
Chi Square		20.33 p=.437			10.30 p=.415		7.53 p=.674		23.39 p=.270		

TABLE 17: Scourers and descalers

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Steelwool	44	0	31	13	18	26	9	35	8	14	22
	31.88	0.00	48.44	36.11	25.00	39.39	16.67	41.67	20.51	23.33	56.41
		0.00	70.45	29.55	40.91	59.09	20.45	79.55	18.18	31.82	50.00
VIMx	40	22	11	7	26	14	22	18	11	24	5
	28.99	57.89	17.19	19.44	36.11	21.21	40.74	21.43	28.21	40.00	12.82
		55.00	27.50	17.50	65.00	35.00	55.00	45.00	27.50	60.00	12.50
Chemico	12	7	4	1	10	2	9	3	7	4	1
	8.70	18.42	6.25	2.78	13.89	3.03	16.67	3.57	17.95	6.67	2.56
		58.33	33.33	8.33	83.33	16.67	75.00	25.00	58.33	33.33	8.33
Any	12	0	7	5	2	10	2	10	5	5	2
	8.70	0.00	10.94	13.89	2.78	15.15	3.70	11.90	12.82	8.33	5.13
		0.00	58.33	41.67	16.67	83.33	16.67	83.33	41.67	41.67	16.67
On sale	9	1	5	3	5	4	4	5	2	4	3
	6.52	2.63	7.81	8.33	6.94	6.06	7.41	5.95	5.13	6.67	7.69
		11.11	55.56	33.33	55.56	44.44	44.44	55.56	22.22	44.44	33.33
other steel wool	8	0	3	5	3	5	0	8	2	2	4
	5.80	0.00	4.69	13.89	4.17	7.58	0.00	9.52	5.13	3.33	10.26
		0.00	37.50	62.50	37.50	62.50	0.00	100.00	25.00	25.00	50.00
No name brand	4	0	3	1	1	3	0	4	1	2	1
	2.90	0.00	4.69	2.78	1.39	4.55	0.00	4.76	2.56	3.33	2.56
		0.00	75.00	25.00	25.00	75.00	0.00	100.00	25.00	50.00	25.00
Ajax	3	2	0	1	2	1	2	1	1	2	0
	2.17	5.26	0.00	2.78	2.78	1.52	3.70	1.19	2.56	3.33	0.00
		66.67	0.00	33.33	66.67	33.33	66.67	33.33	33.33	66.67	0.00
Scotch	2	2	0	0	2	0	2	0	0	1	1
	1.45	5.26	0.00	0.00	2.78	0.00	3.70	0.00	0.00	1.67	2.56
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	50.00	50.00
Pine Cell	2	2	0	0	1	1	2	0	0	2	0
	1.45	5.26	0.00	0.00	1.39	1.52	3.70	0.00	0.00	3.33	0.00
		100.00	0.00	0.00	50.00	50.00	100.00	0.00	0.00	100.00	0.00
VIM and kettle descaler	1	1	0	0	1	0	1	0	1	0	0
	0.72	2.63	0.00	0.00	1.39	0.00	1.85	0.00	2.56	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 17: Scourers and descalers

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.72	2.63	0.00	0.00	1.39	0.00	1.85	0.00	2.56	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	210	99	64	47	137	73	118	92	67	79	64
MEAN	9.7	6.9	10.5	11.4	10.2	9.3	11.0	8.9	8.6	10.2	10.2
S.D.	23.7	15.6	26.0	26.8	24.5	23.0	25.3	22.8	21.4	24.0	26.0
Chi Square		72.14			21.45		37.81		35.61		
		p=.001			p=.029		p=.001		p=.033		

TABLE 18: Hair conditioner

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Magic style	19	0	16	3	13	6	7	12	1	8	10
	15.08	0.00	37.21	21.43	12.87	24.00	8.54	27.27	2.63	13.79	33.33
		0.00	84.21	15.79	68.42	31.58	36.84	63.16	5.26	42.11	52.63
Soft'n Free	10	0	10	0	9	1	5	5	1	5	4
	7.94	0.00	23.26	0.00	8.91	4.00	6.10	11.36	2.63	8.62	13.33
		0.00	100.00	0.00	90.00	10.00	50.00	50.00	10.00	50.00	40.00
Black like me	9	0	6	3	4	5	2	7	1	0	8
	7.14	0.00	13.95	21.43	3.96	20.00	2.44	15.91	2.63	0.00	26.67
		0.00	66.67	33.33	44.44	55.56	22.22	77.78	11.11	0.00	88.89
Flex	9	9	0	0	9	0	8	1	4	5	0
	7.14	13.04	0.00	0.00	8.91	0.00	9.76	2.27	10.53	8.62	0.00
		100.00	0.00	0.00	100.00	0.00	88.89	11.11	44.44	55.56	0.00
Colgate	7	7	0	0	6	1	7	0	4	3	0
	5.56	10.14	0.00	0.00	5.94	4.00	8.54	0.00	10.53	5.17	0.00
		100.00	0.00	0.00	85.71	14.29	100.00	0.00	57.14	42.86	0.00
On sale	6	4	1	1	5	1	5	1	2	3	1
	4.76	5.80	2.33	7.14	4.95	4.00	6.10	2.27	5.26	5.17	3.33
		66.67	16.67	16.67	83.33	16.67	83.33	16.67	33.33	50.00	16.67
Glycerine	5	0	2	3	2	3	1	4	1	4	0
	3.97	0.00	4.65	21.43	1.98	12.00	1.22	9.09	2.63	6.90	0.00
		0.00	40.00	60.00	40.00	60.00	20.00	80.00	20.00	80.00	0.00
Gliss	5	5	0	0	5	0	5	0	3	2	0
	3.97	7.25	0.00	0.00	4.95	0.00	6.10	0.00	7.89	3.45	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	60.00	40.00	0.00
VO5	4	4	0	0	4	0	4	0	2	1	1
	3.17	5.80	0.00	0.00	3.96	0.00	4.88	0.00	5.26	1.72	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	25.00	25.00
Organics	4	4	0	0	4	0	3	1	1	3	0
	3.17	5.80	0.00	0.00	3.96	0.00	3.66	2.27	2.63	5.17	0.00
		100.00	0.00	0.00	100.00	0.00	75.00	25.00	25.00	75.00	0.00
Revlon	3	2	1	0	3	0	2	1	0	2	1
	2.38	2.90	2.33	0.00	2.97	0.00	2.44	2.27	0.00	3.45	3.33
		66.67	33.33	0.00	100.00	0.00	66.67	33.33	0.00	66.67	33.33

TABLE 18: Hair conditioner

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Palmolive	3	3	0	0	2	1	3	0	2	1	0
	2.38	4.35	0.00	0.00	1.98	4.00	3.66	0.00	5.26	1.72	0.00
		100.00	0.00	0.00	66.67	33.33	100.00	0.00	66.67	33.33	0.00
Protein Feed	3	3	0	0	3	0	3	0	1	2	0
	2.38	4.35	0.00	0.00	2.97	0.00	3.66	0.00	2.63	3.45	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
Tomitei	3	3	0	0	3	0	3	0	1	2	0
	2.38	4.35	0.00	0.00	2.97	0.00	3.66	0.00	2.63	3.45	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	66.67	0.00
Medi-scalp	3	3	0	0	3	0	2	1	2	1	0
	2.38	4.35	0.00	0.00	2.97	0.00	2.44	2.27	5.26	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	66.67	33.33	66.67	33.33	0.00
Zini	3	3	0	0	3	0	3	0	2	1	0
	2.38	4.35	0.00	0.00	2.97	0.00	3.66	0.00	5.26	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	66.67	33.33	0.00
Ordinary	2	0	1	1	1	1	1	1	0	2	0
	1.59	0.00	2.33	7.14	0.99	4.00	1.22	2.27	0.00	3.45	0.00
		0.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00	100.00	0.00
Perfect choice	2	0	0	2	0	2	0	2	0	1	1
	1.59	0.00	0.00	14.29	0.00	8.00	0.00	4.55	0.00	1.72	3.33
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00
Easy Waves jell	2	0	2	0	2	0	0	2	0	1	1
	1.59	0.00	4.65	0.00	1.98	0.00	0.00	4.55	0.00	1.72	3.33
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	50.00	50.00
Dark and Lovely	2	0	2	0	1	1	0	2	0	2	0
	1.59	0.00	4.65	0.00	0.99	4.00	0.00	4.55	0.00	3.45	0.00
		0.00	100.00	0.00	50.00	50.00	0.00	100.00	0.00	100.00	0.00
Silkience	2	2	0	0	2	0	2	0	1	1	0
	1.59	2.90	0.00	0.00	1.98	0.00	2.44	0.00	2.63	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Johnsons	2	2	0	0	2	0	2	0	2	0	0
	1.59	2.90	0.00	0.00	1.98	0.00	2.44	0.00	5.26	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 18: Hair conditioner

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Aqua marine	2	2	0	0	2	0	2	0	1	1	0
	1.59	2.90	0.00	0.00	1.98	0.00	2.44	0.00	2.63	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Body-on-tap	2	2	0	0	2	0	2	0	0	1	1
	1.59	2.90	0.00	0.00	1.98	0.00	2.44	0.00	0.00	1.72	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	50.00	50.00
Two-in-one	2	2	0	0	2	0	2	0	0	1	1
	1.59	2.90	0.00	0.00	1.98	0.00	2.44	0.00	0.00	1.72	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	50.00	50.00
Sta-Soft	1	0	1	0	0	1	0	1	0	1	0
	0.79	0.00	2.33	0.00	0.00	4.00	0.00	2.27	0.00	1.72	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
Super Curl	1	0	0	1	0	1	0	1	1	0	0
	0.79	0.00	0.00	7.14	0.00	4.00	0.00	2.27	2.63	0.00	0.00
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	100.00	0.00	0.00
Hair food	1	0	1	0	0	1	0	1	0	1	0
	0.79	0.00	2.33	0.00	0.00	4.00	0.00	2.27	0.00	1.72	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
Pears	1	1	0	0	1	0	1	0	1	0	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	2.63	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Intensive Care	1	1	0	0	1	0	1	0	0	0	1
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	0.00	0.00	3.33
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
Salon Selective	1	1	0	0	1	0	1	0	0	1	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	0.00	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Elseve	1	1	0	0	1	0	1	0	0	1	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	0.00	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Jane Seymour	1	1	0	0	1	0	0	1	1	0	0
	0.79	1.45	0.00	0.00	0.99	0.00	0.00	2.27	2.63	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	0.00	100.00	100.00	0.00	0.00

TABLE 18: Hair conditioner

		AREA OF INTERVIEW			INDOOR.PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Vibrans	1	1	0	0	1	0	1	0	1	0	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	2.63	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Tresem	1	1	0	0	1	0	1	0	0	1	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	0.00	1.72	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Wella Balsam	1	1	0	0	1	0	1	0	1	0	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	2.63	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.79	1.45	0.00	0.00	0.99	0.00	1.22	0.00	2.63	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	222	68	85	69	108	114	90	132	68	81	73
MEAN	17.4	25.6	6.5	10.9	19.5	9.2	22.2	8.5	23.0	17.4	10.5
S.D.	20.8	19.6	14.7	25.5	20.8	19.1	21.8	15.3	20.1	21.4	18.8
Chi Square		162.17			51.90		66.24		96.98		
		p=.001			p=.042		p=.002		p=.027		

TABLE 19: Body creams

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Dawn	66	17	30	19	35	31	25	41	13	30	23
	21.29	16.83	23.62	23.17	20.35	22.46	17.73	24.26	15.29	23.62	23.47
		25.76	45.45	28.79	53.03	46.97	37.88	62.12	19.70	45.45	34.85
Vaseline	54	13	29	12	27	27	18	36	9	23	22
	17.42	12.87	22.83	14.63	15.70	19.57	12.77	21.30	10.59	18.11	22.45
		24.07	53.70	22.22	50.00	50.00	33.33	66.67	16.67	42.59	40.74
Blue seal	33	0	20	13	14	19	8	25	5	13	15
	10.65	0.00	15.75	15.85	8.14	13.77	5.67	14.79	5.88	10.24	15.31
		0.00	60.61	39.39	42.42	57.58	24.24	75.76	15.15	39.39	45.45
Camphor cream	27	1	16	10	10	17	8	19	4	9	14
	8.71	0.99	12.60	12.20	5.81	12.32	5.67	11.24	4.71	7.09	14.29
		3.70	59.26	37.04	37.04	62.96	29.63	70.37	14.81	33.33	51.85
Vaseline intensive care	24	21	2	1	22	2	21	3	12	9	3
	7.74	20.79	1.57	1.22	12.79	1.45	14.89	1.78	14.12	7.09	3.06
		87.50	8.33	4.17	91.67	8.33	87.50	12.50	50.00	37.50	12.50
Ponds aqua cream	21	16	4	1	18	3	18	3	6	13	2
	6.77	15.84	3.15	1.22	10.47	2.17	12.77	1.78	7.06	10.24	2.04
		76.19	19.05	4.76	85.71	14.29	85.71	14.29	28.57	61.90	9.52
On sale	12	7	2	3	7	5	7	5	6	5	1
	3.87	6.93	1.57	3.66	4.07	3.62	4.96	2.96	7.06	3.94	1.02
		58.33	16.67	25.00	58.33	41.67	58.33	41.67	50.00	41.67	8.33
Mousson	10	0	6	4	5	5	3	7	2	6	2
	3.23	0.00	4.72	4.88	2.91	3.62	2.13	4.14	2.35	4.72	2.04
		0.00	60.00	40.00	50.00	50.00	30.00	70.00	20.00	60.00	20.00
Vaseline cream	10	1	2	7	2	8	1	9	4	3	3
	3.23	0.99	1.57	8.54	1.16	5.80	0.71	5.33	4.71	2.36	3.06
		10.00	20.00	70.00	20.00	80.00	10.00	90.00	40.00	30.00	30.00
Vaseline and Dawn	6	0	4	2	3	3	1	5	1	2	3
	1.94	0.00	3.15	2.44	1.74	2.17	0.71	2.96	1.18	1.57	3.06
		0.00	66.67	33.33	50.00	50.00	16.67	83.33	16.67	33.33	50.00
Coiv Butter	6	2	1	3	3	3	3	3	3	1	2
	1.94	1.98	0.79	3.66	1.74	2.17	2.13	1.78	3.53	0.79	2.04
		33.33	16.67	50.00	50.00	50.00	50.00	50.00	50.00	16.67	33.33

TABLE 19: Body creams

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Baby Oil	5	4	0	1	3	2	4	1	3	2	0
	1.61	3.96	0.00	1.22	1.74	1.45	2.84	0.59	3.53	1.57	0.00
		80.00	0.00	20.00	60.00	40.00	80.00	20.00	60.00	40.00	0.00
Petroleum Jelly	4	0	4	0	1	3	2	2	0	3	1
	1.29	0.00	3.15	0.00	0.58	2.17	1.42	1.18	0.00	2.36	1.02
		0.00	100.00	0.00	25.00	75.00	50.00	50.00	0.00	75.00	25.00
Glycerine	3	0	2	1	2	1	1	2	0	1	2
	0.97	0.00	1.57	1.22	1.16	0.72	0.71	1.18	0.00	0.79	2.04
		0.00	66.67	33.33	66.67	33.33	33.33	66.67	0.00	33.33	66.67
Clere body cream	2	0	2	0	1	1	1	1	0	0	2
	0.65	0.00	1.57	0.00	0.58	0.72	0.71	0.59	0.00	0.00	2.04
		0.00	100.00	0.00	50.00	50.00	50.00	50.00	0.00	0.00	100.00
No name brand	2	1	1	0	1	1	1	1	1	1	0
	0.65	0.99	0.79	0.00	0.58	0.72	0.71	0.59	1.18	0.79	0.00
		50.00	50.00	0.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
Camphor and Vaseline	2	1	1	0	2	0	2	0	0	2	0
	0.65	0.99	0.79	0.00	1.16	0.00	1.42	0.00	0.00	1.57	0.00
		50.00	50.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Dawn and Glycerine	2	0	0	2	0	2	0	2	1	0	1
	0.65	0.00	0.00	2.44	0.00	1.45	0.00	1.18	1.18	0.00	1.02
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	50.00	0.00	50.00
Nulon	2	1	0	1	1	1	1	1	1	1	0
	0.65	0.99	0.00	1.22	0.58	0.72	0.71	0.59	1.18	0.79	0.00
		50.00	0.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
Avroy Shlain	2	2	0	0	2	0	2	0	2	0	0
	0.65	1.98	0.00	0.00	1.16	0.00	1.42	0.00	2.35	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Valeur	2	2	0	0	2	0	2	0	2	0	0
	0.65	1.98	0.00	0.00	1.16	0.00	1.42	0.00	2.35	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Nivea	2	2	0	0	2	0	2	0	2	0	0
	0.65	1.98	0.00	0.00	1.16	0.00	1.42	0.00	2.35	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 19: Body creams

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Jewel vaseline	1	0	1	0	0	1	0	1	0	0	1
	0.32	0.00	0.79	0.00	0.00	0.72	0.00	0.59	0.00	0.00	1.02
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
Sadie	1	0	0	1	0	1	0	1	1	0	0
	0.32	0.00	0.00	1.22	0.00	0.72	0.00	0.59	1.18	0.00	0.00
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	100.00	0.00	0.00
Mousson and Vaseline	1	0	0	1	0	1	0	1	0	1	0
	0.32	0.00	0.00	1.22	0.00	0.72	0.00	0.59	0.00	0.79	0.00
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00
Tou're the fire	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Hand and body lotion	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Lubriderm	1	1	0	0	0	1	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.00	0.72	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	0.00	100.00	100.00	0.00	100.00	0.00	0.00
Woolworths	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Charlie	1	1	0	0	1	0	1	0	0	1	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	0.00	0.79	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Nivea	1	1	0	0	1	0	1	0	0	1	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	0.00	0.79	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Brunel	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Justine	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00

TABLE 19: Body creams

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Yardleys	1	1	0	0	1	0	1	0	0	0	1
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	0.00	0.00	1.02
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
make own	1	1	0	0	1	0	1	0	1	0	0
	0.32	0.99	0.00	0.00	0.58	0.00	0.71	0.00	1.18	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	38	36	1	1	37	1	31	7	21	12	5
MEAN	11.3	17.4	7.3	9.8	12.3	9.9	14.2	8.9	17.0	10.6	7.1
S.D.	18.8	24.0	12.3	18.2	19.4	18.0	21.1	16.4	24.4	18.7	10.5
Chi Square		171.06			55.60		81.60		101.69		
		p=.001			p=.011		p=.001		p=.005		

TABLE 20: Bath oil/ foam

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
On sale	14	14	0	0	12	2	13	1	4	10	0
	25.45	32.56	0.00	0.00	24.00	40.00	28.26	11.11	18.18	38.46	0.00
		100.00	0.00	0.00	85.71	14.29	92.86	7.14	28.57	71.43	0.00
Radox	10	6	4	0	9	1	8	2	2	5	3
	18.18	13.95	33.33	0.00	18.00	20.00	17.39	22.22	9.09	19.23	42.86
		60.00	40.00	0.00	90.00	10.00	80.00	20.00	20.00	50.00	30.00
Mousson	6	1	5	0	4	2	3	3	2	3	1
	10.91	2.33	41.67	0.00	8.00	40.00	6.52	33.33	9.09	11.54	14.29
		16.67	83.33	0.00	66.67	33.33	50.00	50.00	33.33	50.00	16.67
Johnson and Johnson	6	5	1	0	6	0	5	1	3	1	2
	10.91	11.63	8.33	0.00	12.00	0.00	10.87	11.11	13.64	3.85	28.57
		83.33	16.67	0.00	100.00	0.00	83.33	16.67	50.00	16.67	33.33
Woolworths	5	5	0	0	5	0	4	1	4	1	0
	9.09	11.63	0.00	0.00	10.00	0.00	8.70	11.11	18.18	3.85	0.00
		100.00	0.00	0.00	100.00	0.00	80.00	20.00	80.00	20.00	0.00
Dettol	3	2	1	0	3	0	2	1	1	2	0
	5.45	4.65	8.33	0.00	6.00	0.00	4.35	11.11	4.55	7.69	0.00
		66.67	33.33	0.00	100.00	0.00	66.67	33.33	33.33	66.67	0.00
Vaseline	3	3	0	0	3	0	3	0	1	1	1
	5.45	6.98	0.00	0.00	6.00	0.00	6.52	0.00	4.55	3.85	14.29
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	33.33	33.33	33.33
20	2	2	0	0	2	0	2	0	1	1	0
	3.64	4.65	0.00	0.00	4.00	0.00	4.35	0.00	4.55	3.85	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	50.00	0.00
Fenjal	1	0	1	0	1	0	1	0	0	1	0
	1.82	0.00	8.33	0.00	2.00	0.00	2.17	0.00	0.00	3.85	0.00
		0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Lux foam bath	1	1	0	0	1	0	1	0	1	0	0
	1.82	2.33	0.00	0.00	2.00	0.00	2.17	0.00	4.55	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Yardley	1	1	0	0	1	0	1	0	0	1	0
	1.82	2.33	0.00	0.00	2.00	0.00	2.17	0.00	0.00	3.85	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00

TABLE 20: Bath oil/ foam

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Justine	1	1	0	0	1	0	1	0	1	0	0
	1.82	2.33	0.00	0.00	2.00	0.00	2.17	0.00	4.55	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Badedas	1	1	0	0	1	0	1	0	1	0	0
	1.82	2.33	0.00	0.00	2.00	0.00	2.17	0.00	4.55	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	1.82	2.33	0.00	0.00	2.00	0.00	2.17	0.00	4.55	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	293	94	116	83	159	134	126	167	84	113	96
MEAN	29.6	36.9	3.3	0.0	28.3	41.8	32.5	14.6	23.8	41.2	4.6
S.D.	41.1	43.8	1.1	0.0	40.3	52.2	42.4	31.7	36.5	46.7	2.1
Chi Square		27.25			7.23		8.76		24.59		
		p=.396			p=.890		p=.791		p=.542		

TABLE 21: Appliance cleaners

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Handy Andy	190	122	51	17	151	39	141	49	71	78	41
	82.61	97.60	68.00	56.67	90.96	60.94	95.92	59.04	87.65	83.87	73.21
		64.21	26.84	8.95	79.47	20.53	74.21	25.79	37.37	41.05	21.58
VIM	18	0	10	8	6	12	0	18	4	9	5
	7.83	0.00	13.33	26.67	3.61	18.75	0.00	21.69	4.94	9.68	8.93
		0.00	55.56	44.44	33.33	66.67	0.00	100.00	22.22	50.00	27.78
Chemico	12	0	8	4	5	7	2	10	3	3	6
	5.22	0.00	10.67	13.33	3.01	10.94	1.36	12.05	3.70	3.23	10.71
		0.00	66.67	33.33	41.67	58.33	16.67	83.33	25.00	25.00	50.00
On sale	3	2	1	0	2	1	2	1	2	1	0
	1.30	1.60	1.33	0.00	1.20	1.56	1.36	1.20	2.47	1.08	0.00
		66.67	33.33	0.00	66.67	33.33	66.67	33.33	66.67	33.33	0.00
Steelwool	2	0	2	0	0	2	0	2	0	0	2
	0.87	0.00	2.67	0.00	0.00	3.13	0.00	2.41	0.00	0.00	3.57
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
No name brand	2	0	2	0	1	1	1	1	0	1	1
	0.87	0.00	2.67	0.00	0.60	1.56	0.68	1.20	0.00	1.08	1.79
		0.00	100.00	0.00	50.00	50.00	50.00	50.00	0.00	50.00	50.00
Any	1	0	0	1	0	1	0	1	1	0	0
	0.43	0.00	0.00	3.33	0.00	1.56	0.00	1.20	1.23	0.00	0.00
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	100.00	0.00	0.00
Pine Gell	1	1	0	0	1	0	1	0	0	1	0
	0.43	0.80	0.00	0.00	0.60	0.00	0.68	0.00	0.00	1.08	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
10	1	0	1	0	0	1	0	1	0	0	1
	0.43	0.00	1.33	0.00	0.00	1.56	0.00	1.20	0.00	0.00	1.79
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
NO RESPONSE or NIL	118	12	53	53	43	75	25	93	25	46	47
MEAN	3.4	3.6	3.5	2.0	3.2	3.7	3.4	3.3	4.4	3.1	2.3
S.D.	11.1	12.2	11.2	1.0	10.6	12.2	11.3	10.7	15.2	10.1	1.3
Chi Square		66.97			35.42		60.06		22.06		
		p=.001			p=.001		p=.001		p=.141		

TABLE 22: Dishwashing Liquid

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Sunlight liquid	223	110	82	31	158	65	134	89	76	88	59
	77.16	80.88	78.85	63.27	79.80	71.43	80.72	72.36	82.61	73.95	75.64
		49.33	36.77	13.90	70.85	29.15	60.09	39.91	34.08	39.46	26.46
No name brand	18	2	9	7	7	11	4	14	3	7	8
	6.23	1.47	8.65	14.29	3.54	12.09	2.41	11.38	3.26	5.88	10.26
		11.11	50.00	38.89	38.89	61.11	22.22	77.78	16.67	38.89	44.44
On sale	16	12	3	1	14	2	14	2	4	9	3
	5.54	8.82	2.88	2.04	7.07	2.20	8.43	1.63	4.35	7.56	3.85
		75.00	18.75	6.25	87.50	12.50	87.50	12.50	25.00	56.25	18.75
Ajax	7	4	2	1	6	1	4	3	2	4	1
	2.42	2.94	1.92	2.04	3.03	1.10	2.41	2.44	2.17	3.36	1.28
		57.14	28.57	14.29	85.71	14.29	57.14	42.86	28.57	57.14	14.29
Omo	5	0	0	5	0	5	0	5	2	2	1
	1.73	0.00	0.00	10.20	0.00	5.49	0.00	4.07	2.17	1.68	1.28
		0.00	0.00	100.00	0.00	100.00	0.00	100.00	40.00	40.00	20.00
Lemon	4	1	1	2	2	2	2	2	2	2	0
	1.38	0.74	0.96	4.08	1.01	2.20	1.20	1.63	2.17	1.68	0.00
		25.00	25.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	0.00
Surf	4	0	3	1	3	1	0	4	0	1	3
	1.38	0.00	2.88	2.04	1.52	1.10	0.00	3.25	0.00	0.84	3.85
		0.00	75.00	25.00	75.00	25.00	0.00	100.00	0.00	25.00	75.00
Zipp	2	0	2	0	1	1	1	1	0	0	2
	0.69	0.00	1.92	0.00	0.51	1.10	0.60	0.81	0.00	0.00	2.56
		0.00	100.00	0.00	50.00	50.00	50.00	50.00	0.00	0.00	100.00
Bingo	2	0	1	1	0	2	0	2	1	0	1
	0.69	0.00	0.96	2.04	0.00	2.20	0.00	1.63	1.09	0.00	1.28
		0.00	50.00	50.00	0.00	100.00	0.00	100.00	50.00	0.00	50.00
Bio Classic	2	2	0	0	2	0	2	0	0	2	0
	0.69	1.47	0.00	0.00	1.01	0.00	1.20	0.00	0.00	1.68	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Any	1	0	1	0	0	1	0	1	0	1	0
	0.35	0.00	0.96	0.00	0.00	1.10	0.00	0.81	0.00	0.84	0.00
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00

TABLE 22: Dishwashing Liquid

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Polaric	1	1	0	0	1	0	1	0	0	1	0
	0.35	0.74	0.00	0.00	0.51	0.00	0.60	0.00	0.00	0.84	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Chembrite	1	1	0	0	1	0	1	0	0	1	0
	0.35	0.74	0.00	0.00	0.51	0.00	0.60	0.00	0.00	0.84	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
NJ Chemicals	1	1	0	0	1	0	1	0	0	1	0
	0.35	0.74	0.00	0.00	0.51	0.00	0.60	0.00	0.00	0.84	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Sporton	1	1	0	0	1	0	1	0	1	0	0
	0.35	0.74	0.00	0.00	0.51	0.00	0.60	0.00	1.09	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
Make own	1	1	0	0	1	0	1	0	1	0	0
	0.35	0.74	0.00	0.00	0.51	0.00	0.60	0.00	1.09	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	59	1	24	34	11	48	6	53	14	20	25
MEAN	8.0	11.2	5.3	4.8	9.4	4.8	10.7	4.3	6.7	10.1	6.3
S.D.	22.2	27.5	16.3	13.8	24.9	14.3	27.0	12.3	19.9	25.6	18.7
Chi Square		64.78			33.18		37.20		32.69		
		p=.001			p=.004		p=.001		p=.336		

TABLE 23: Drain cleaners

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Jeyes fluid	39	28	8	3	33	6	32	7	12	23	4
	56.52	59.57	50.00	50.00	60.00	42.86	62.75	38.89	60.00	63.89	30.77
		71.79	20.51	7.69	84.62	15.38	82.05	17.95	30.77	58.97	10.26
Littels Dip	7	0	4	3	2	5	1	6	1	2	4
	10.14	0.00	25.00	50.00	3.64	35.71	1.96	33.33	5.00	5.56	30.77
		0.00	57.14	42.86	28.57	71.43	14.29	85.71	14.29	28.57	57.14
Drain Kleen	6	5	1	0	5	1	4	2	3	2	1
	8.70	10.64	6.25	0.00	9.09	7.14	7.84	11.11	15.00	5.56	7.69
		83.33	16.67	0.00	83.33	16.67	66.67	33.33	50.00	33.33	16.67
Domestos	5	5	0	0	5	0	3	2	2	3	0
	7.25	10.64	0.00	0.00	9.09	0.00	5.88	11.11	10.00	8.33	0.00
		100.00	0.00	0.00	100.00	0.00	60.00	40.00	40.00	60.00	0.00
Dry Clean	2	2	0	0	1	1	2	0	0	2	0
	2.90	4.26	0.00	0.00	1.82	7.14	3.92	0.00	0.00	5.56	0.00
		100.00	0.00	0.00	50.00	50.00	100.00	0.00	0.00	100.00	0.00
Pool cleaner	2	2	0	0	2	0	2	0	0	2	0
	2.90	4.26	0.00	0.00	3.64	0.00	3.92	0.00	0.00	5.56	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
NJ Chemicals	2	2	0	0	2	0	2	0	1	0	1
	2.90	4.26	0.00	0.00	3.64	0.00	3.92	0.00	5.00	0.00	7.69
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	50.00	0.00	50.00
Zipp	1	0	1	0	1	0	1	0	0	0	1
	1.45	0.00	6.25	0.00	1.82	0.00	1.96	0.00	0.00	0.00	7.69
		0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
Any	1	0	1	0	1	0	1	0	0	1	0
	1.45	0.00	6.25	0.00	1.82	0.00	1.96	0.00	0.00	2.78	0.00
		0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00
Chemico	1	0	1	0	0	1	0	1	0	0	1
	1.45	0.00	6.25	0.00	0.00	7.14	0.00	5.56	0.00	0.00	7.69
		0.00	100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
Harpic	1	1	0	0	1	0	1	0	0	1	0
	1.45	2.13	0.00	0.00	1.82	0.00	1.96	0.00	0.00	2.78	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00

TABLE 23: Drain cleaners

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Sanpic	1	1	0	0	1	0	1	0	0	0	1
	1.45	2.13	0.00	0.00	1.82	0.00	1.96	0.00	0.00	0.00	7.69
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	0.00	0.00	100.00
Baking soda and vinegar	1	1	0	0	1	0	1	0	1	0	0
	1.45	2.13	0.00	0.00	1.82	0.00	1.96	0.00	5.00	0.00	0.00
		100.00	0.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	0.00
NO RESPONSE or NIL	279	90	112	77	154	125	121	158	86	103	90
MEAN	3.2	3.4	2.8	2.5	3.1	3.4	3.3	3.0	3.1	2.8	4.5
S.D.	3.3	3.8	2.1	1.6	3.5	2.6	3.7	2.0	3.6	3.0	3.6
Chi Square		35.21			20.53		21.63		34.43		
		p=.065			p=.058		p=.042		p=.077		

TABLE 24: *Expenditure profile*

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES 196848	%1148174	894179	184464	69531	998125	150049	973261	174913	388458	562868	
Savings	277395.00	262427.00	11075.00	3893.00	269306.00	8089.00	264527.00	12868.00	101467.00	157667.00	18261.0
	24.16	29.35	6.00	5.60	26.98	5.39	27.18	7.36	26.12	28.01	9.2
		94.60	3.99	1.40	97.08	2.92	95.36	4.64	36.58	56.84	6.5
	835.53	2168.82	86.52	46.90	1395.37	58.19	1684.89	73.53	1046.05	1176.62	180.8
	2628.89	4025.98	164.98	82.06	3339.39	119.68	3640.77	167.39	2901.50	3145.19	1002.5
Groceries	153108.00	110139.00	28447.00	14522.00	124746.00	28362.00	118329.00	34779.00	49488.00	74773.00	28847.0
	13.33	12.32	15.42	20.89	12.50	18.90	12.16	19.88	12.74	13.28	14.6
		71.94	18.58	9.48	81.48	18.52	77.28	22.72	32.32	48.84	18.8
	461.17	910.24	222.24	174.96	646.35	204.04	753.69	198.74	510.19	558.01	285.6
	660.98	921.72	147.54	130.31	800.55	204.25	858.46	154.68	381.30	932.81	321.3
Rent	122363.00	104851.00	15351.00	2161.00	111761.00	10602.00	112834.00	9529.00	54042.00	51483.00	16838.0
	10.66	11.73	8.32	3.11	11.20	7.07	11.59	5.45	13.91	9.15	8.5
		85.69	12.55	1.77	91.34	8.66	92.21	7.79	44.17	42.07	13.7
	368.56	866.54	119.93	26.04	579.07	76.27	718.69	54.45	557.13	384.20	166.7
	914.95	1353.12	261.49	112.71	1139.95	227.84	1224.62	195.19	1468.79	611.52	355.7
Insurance	82292.00	69385.00	9998.00	2909.00	75780.00	6512.00	73769.00	8523.00	36311.00	26461.00	19520.0
	7.17	7.76	5.42	4.18	7.59	4.34	7.58	4.87	9.35	4.70	9.9
		84.32	12.15	3.53	92.09	7.91	89.64	10.36	44.12	32.16	23.7
	247.87	573.43	78.11	35.05	392.64	46.85	469.87	48.70	374.34	197.47	193.2
	971.28	1548.66	165.98	91.34	1248.98	149.56	1374.51	128.04	1426.45	297.44	1014.7
Vehicle	73495.00	63285.00	6200.00	4010.00	59805.00	13690.00	65995.00	7500.00	29675.00	35420.00	8400.0
	6.40	7.08	3.36	5.77	5.99	9.12	6.78	4.29	7.64	6.29	4.2
		86.11	8.44	5.46	81.37	18.63	89.80	10.20	40.38	48.19	11.4
	221.37	523.02	48.44	48.31	309.87	98.49	420.35	42.86	305.93	264.33	83.1
	589.22	842.92	159.94	332.81	576.05	587.27	771.52	242.91	728.70	612.38	334.5
Clothing and shoes	63441.00	22975.00	27713.00	12753.00	39839.00	23602.00	34864.00	28577.00	14040.00	27402.00	21999.0
	5.53	2.57	15.02	18.34	3.99	15.73	3.58	16.34	3.61	4.87	11.1
		36.21	43.68	20.10	62.80	37.20	54.95	45.05	22.13	43.19	34.6
	191.09	189.88	216.51	153.65	206.42	169.80	222.06	163.30	144.74	204.49	217.8
	217.83	185.77	264.30	174.37	217.95	216.63	226.71	206.25	179.06	221.62	240.6
Entertainment	55866.00	51326.00	3405.00	1135.00	53672.00	2194.00	53372.00	2494.00	25433.00	17955.00	12478.0
	4.87	5.74	1.85	1.63	5.38	1.46	5.48	1.43	6.55	3.19	6.3
		91.87	6.09	2.03	96.07	3.93	95.54	4.46	45.53	32.14	22.3
	168.27	424.18	26.60	13.67	278.09	15.78	339.95	14.25	262.20	133.99	123.5
	1091.64	1782.56	64.60	40.17	1422.57	48.96	1571.74	40.55	1424.07	865.93	994.0
Furniture	48009.00	25789.00	17003.00	5217.00	38267.00	9742.00	35366.00	12643.00	5679.00	31399.00	10931.0
	4.18	2.88	9.22	7.50	3.83	6.49	3.63	7.23	1.46	5.58	5.5
		53.72	35.42	10.87	79.71	20.29	73.67	26.33	11.83	65.40	22.7
	144.61	213.13	132.84	62.86	198.27	70.09	225.26	72.25	58.55	234.32	108.2
	787.74	1281.97	217.74	111.75	1025.29	127.31	1135.33	116.95	146.52	1221.42	172.8

TABLE 24: Expenditure profile

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES 196848	%1148174	894179	184464	69531	998125	150049	973261	174913	388458	562868	
Alcohol	47491.00	44371.00	2065.00	1055.00	45712.00	1779.00	44892.00	2599.00	12484.00	33241.00	1766.0
	4.14	4.96	1.12	1.52	4.58	1.19	4.61	1.49	3.21	5.91	0.9
		93.43	4.35	2.22	96.25	3.75	94.53	5.47	26.29	69.99	3.7
	143.05	366.70	16.13	12.71	236.85	12.80	285.94	14.85	128.70	248.07	17.4
	1090.97	1789.38	34.63	26.04	1424.84	28.28	1576.46	32.20	1013.90	1481.88	34.0
Loans	41100.00	35925.00	4855.00	320.00	39890.00	1210.00	38735.00	2365.00	3775.00	25148.00	12177.0
	3.58	4.02	2.63	0.46	4.00	0.81	3.98	1.35	0.97	4.47	6.1
		87.41	11.81	0.78	97.06	2.94	94.25	5.75	9.18	61.19	29.6
	123.80	296.90	37.93	3.86	206.68	8.71	246.72	13.51	38.92	187.67	120.5
	953.41	1564.18	108.90	11.02	1245.03	26.18	1377.14	54.85	179.64	1218.92	994.6
Education	40681.00	15629.00	19275.00	5777.00	28386.00	12295.00	26315.00	14366.00	4395.00	22454.00	13832.0
	3.54	1.75	10.45	8.31	2.84	8.19	2.70	8.21	1.13	3.99	7.0
		38.42	47.38	14.20	69.78	30.22	64.69	35.31	10.80	55.20	34.0
	122.53	129.17	150.59	69.60	147.08	88.45	167.61	82.09	45.31	167.57	136.9
	220.70	244.06	242.51	119.32	258.18	148.60	278.52	140.12	145.16	255.10	213.8
Medical	38394.00	26048.00	8971.00	3375.00	30872.00	7522.00	29813.00	8581.00	12211.00	18749.00	7434.0
	3.34	2.91	4.86	4.85	3.09	5.01	3.06	4.91	3.14	3.33	3.7
		67.84	23.37	8.79	80.41	19.59	77.65	22.35	31.80	48.83	19.3
	115.64	215.27	70.09	40.66	159.96	54.12	189.89	49.03	125.89	139.92	73.6
	169.43	222.54	106.32	48.11	198.29	87.09	212.55	68.32	174.40	196.62	108.2
Service	35783.00	24622.00	8292.00	2869.00	30756.00	5027.00	29513.00	6270.00	13899.00	13675.00	8209.0
	3.12	2.75	4.50	4.13	3.08	3.35	3.03	3.58	3.58	2.43	4.1
		68.81	23.17	8.02	85.95	14.05	82.48	17.52	38.84	38.22	22.9
	107.78	203.49	64.78	34.57	159.36	36.17	187.98	35.83	143.29	102.05	81.2
	154.86	193.40	77.41	104.69	172.92	83.89	178.55	77.66	175.91	142.49	143.8
Cigarettes	21281.00	18135.00	1874.00	1272.00	19043.00	2238.00	18457.00	2824.00	13644.00	4769.00	2868.0
	1.85	2.03	1.02	1.83	1.91	1.49	1.90	1.61	3.51	0.85	1.4
		85.22	8.81	5.98	89.48	10.52	86.73	13.27	64.11	22.41	13.4
	64.10	149.88	14.64	15.33	98.67	16.10	117.56	16.14	140.66	35.59	28.4
	550.39	906.47	41.72	23.79	720.24	29.52	797.30	38.12	1012.94	63.26	65.7
Transport	14614.00	2780.00	7840.00	3994.00	6962.00	7652.00	5819.00	8795.00	1969.00	7752.00	4893.0
	1.27	0.31	4.25	5.74	0.70	5.10	0.60	5.03	0.51	1.38	2.4
		19.02	53.65	27.33	47.64	52.36	39.82	60.18	13.47	53.05	33.4
	44.02	22.98	61.25	48.12	36.07	55.05	37.06	50.26	20.30	57.85	48.4
	81.21	103.60	68.42	50.29	89.36	67.05	100.61	58.20	44.54	108.64	58.3
Fuels	14396.00	9822.00	2307.00	2267.00	11240.00	3156.00	10374.00	4022.00	5514.00	5076.00	3806.0
	1.25	1.10	1.25	3.26	1.13	2.10	1.07	2.30	1.42	0.90	1.9
		68.23	16.03	15.75	78.08	21.92	72.06	27.94	38.30	35.26	26.4
	43.36	81.17	18.02	27.31	58.24	22.71	66.08	22.98	56.85	37.88	37.6
	111.11	166.41	53.41	38.94	140.93	35.21	153.67	37.80	130.52	115.20	81.3

TABLE 24: Expenditure profile

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES 196848	%1148174	894179	184464	69531	998125	150049	973261	174913	388458	562868	
Remittances	9910.00	1980.00	6790.00	1140.00	5920.00	3990.00	4540.00	5370.00	1530.00	5800.00	2580.0
	0.86	0.22	3.68	1.64	0.59	2.66	0.47	3.07	0.39	1.03	1.3
		19.98	68.52	11.50	59.74	40.26	45.81	54.19	15.44	58.53	26.0
	29.85	16.36	53.05	13.73	30.67	28.71	28.92	30.69	15.77	43.28	25.5
	156.68	85.29	233.31	52.61	105.45	208.35	101.55	193.53	81.25	224.47	86.3
Chemist items	8555.00	4690.00	3003.00	862.00	6168.00	2387.00	5747.00	2808.00	2902.00	3644.00	2009.0
	0.75	0.52	1.63	1.24	0.62	1.59	0.59	1.61	0.75	0.65	1.0
		54.82	35.10	10.08	72.10	27.90	67.18	32.82	33.92	42.59	23.4
	25.77	38.76	23.46	10.39	31.96	17.17	36.61	16.05	29.92	27.19	19.8
	67.34	96.57	43.57	34.93	71.89	59.66	89.55	35.17	80.91	69.57	47.2
MEAN	192.13	410.55	80.06	46.54	287.31	59.97	344.40	55.53	222.48	233.36	108.2
S.D.	197.58	512.86	64.49	46.82	326.44	53.80	395.96	50.88	263.67	271.19	77.0

\BLE 25: Total expenditure

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	693034	439635	184298	69101	545515	147519	518717	174317	214438	324016	15458
TOTAL EXPENDITURE	693034.00	439635.00	184298.00	69101.00	545515.00	147519.00	518717.00	174317.00	214438.00	324016.00	154580.0
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0
		63.44	26.59	9.97	78.71	21.29	74.85	25.15	30.94	46.75	22.3
	2087.45	3633.35	1439.83	832.54	2826.50	1061.29	3303.93	996.10	2210.70	2418.03	1530.5
	1859.17	1984.66	1142.10	626.83	1913.61	1171.00	1955.68	783.04	1841.86	2114.57	1327.7
MEAN	2087.45	3633.35	1439.83	832.54	2826.50	1061.29	3303.93	996.10	2210.70	2418.03	1530.4
S.D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0

TABLE 26: Does anyone in this households suffer from itchy skin?

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Yes	91	50	30	11	73	18	60	31	31	39	21
	26.15	36.50	23.44	13.25	34.93	12.95	34.88	17.61	29.25	28.06	20.39
		54.95	32.97	12.09	80.22	19.78	65.93	34.07	34.07	42.86	23.08
No	257	87	98	72	136	121	112	145	75	100	82
	73.85	63.50	76.56	86.75	65.07	87.05	65.12	82.39	70.75	71.94	79.61
		33.85	38.13	28.02	52.92	47.08	43.58	56.42	29.18	38.91	31.91
MEAN	1.74	1.64	1.77	1.87	1.65	1.87	1.65	1.82	1.71	1.72	1.80
S.D.	0.44	0.48	0.43	0.34	0.48	0.34	0.48	0.38	0.46	0.45	0.40
Chi Square		15.23			20.88		13.43		2.56		
		p=.001			p=.001		p=.001		p=.278		

TABLE 27: Is this a result of the water quality?

HH member has itchy skin

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	91	50	30	11	73	18	60	31	31	39	21
Yes	54	36	12	6	45	9	41	13	23	23	8
	60.00	72.00	40.00	60.00	61.64	52.94	68.33	43.33	74.19	58.97	40.00
		66.67	22.22	11.11	83.33	16.67	75.93	24.07	42.59	42.59	14.81
No	36	14	18	4	28	8	19	17	8	16	12
	40.00	28.00	60.00	40.00	38.36	47.06	31.67	56.67	25.81	41.03	60.00
		38.89	50.00	11.11	77.78	22.22	52.78	47.22	22.22	44.44	33.33
NO RESPONSE or NIL	1	0	0	1	0	1	0	1	0	0	1
MEAN	1.40	1.28	1.60	1.40	1.38	1.47	1.32	1.57	1.26	1.41	1.60
S.D.	0.49	0.45	0.50	0.52	0.49	0.51	0.47	0.50	0.44	0.50	0.50
Chi Square		8.00			0.44		5.21		5.95		
		p=.018			p=.509		p=.022		p=.051		

TABLE 28: Household size

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX O MORE
TOTAL RESPONSES	1654	485	756	413	942	712	708	946	250	623	
Number of children and adults	1654.00	485.00	756.00	413.00	942.00	712.00	708.00	946.00	250.00	623.00	781
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100
		29.32	45.71	24.97	56.95	43.05	42.81	57.19	15.11	37.67	47
	4.75	3.54	5.91	4.98	4.51	5.12	4.12	5.38	2.36	4.48	7
MEAN	4.75	3.54	5.91	4.98	4.51	5.12	4.12	5.38	2.36	4.48	7
S.D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0

TABLE 29: Itchy skin attributed to water quality

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
Yes	55	36	12	7	45	10	41	14	23	23	9
	15.80	26.28	9.38	8.43	21.53	7.19	23.84	7.95	21.70	16.55	8.74
		65.45	21.82	12.73	81.82	18.18	74.55	25.45	41.82	41.82	16.36
No	293	101	116	76	164	129	131	162	83	116	94
	84.20	73.72	90.63	91.57	78.47	92.81	76.16	92.05	78.30	83.45	91.26
		34.47	39.59	25.94	55.97	44.03	44.71	55.29	28.33	39.59	32.08
MEAN	1.84	1.74	1.91	1.92	1.78	1.93	1.76	1.92	1.78	1.83	1.91
S.D.	0.37	0.44	0.29	0.28	0.41	0.26	0.43	0.27	0.41	0.37	0.28
Chi Square		18.66			12.89		16.49		6.69		
		p=.001			p=.001		p=.001		p=.035		

TABLE 30: Number of houshold members

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
One	16	12	1	3	12	4	12	4	16	0	0
	4.60	8.76	0.78	3.61	5.74	2.88	6.98	2.27	15.09	0.00	0.00
		75.00	6.25	18.75	75.00	25.00	75.00	25.00	100.00	0.00	0.00
Two	36	27	4	5	29	7	26	10	36	0	0
	10.34	19.71	3.13	6.02	13.88	5.04	15.12	5.68	33.96	0.00	0.00
		75.00	11.11	13.89	80.56	19.44	72.22	27.78	100.00	0.00	0.00
Three	54	29	8	17	31	23	29	25	54	0	0
	15.52	21.17	6.25	20.48	14.83	16.55	16.86	14.20	50.94	0.00	0.00
		53.70	14.81	31.48	57.41	42.59	53.70	46.30	100.00	0.00	0.00
Four	72	33	27	12	44	28	39	33	0	72	0
	20.69	24.09	21.09	14.46	21.05	20.14	22.67	18.75	0.00	51.80	0.00
		45.83	37.50	16.67	61.11	38.89	54.17	45.83	0.00	100.00	0.00
Five	67	23	27	17	38	29	29	38	0	67	0
	19.25	16.79	21.09	20.48	18.18	20.86	16.86	21.59	0.00	48.20	0.00
		34.33	40.30	25.37	56.72	43.28	43.28	56.72	0.00	100.00	0.00
Six	35	8	18	9	22	13	20	15	0	0	35
	10.06	5.84	14.06	10.84	10.53	9.35	11.63	8.52	0.00	0.00	33.98
		22.86	51.43	25.71	62.86	37.14	57.14	42.86	0.00	0.00	100.00
Seven	28	3	16	9	13	15	7	21	0	0	28
	8.05	2.19	12.50	10.84	6.22	10.79	4.07	11.93	0.00	0.00	27.18
		10.71	57.14	32.14	46.43	53.57	25.00	75.00	0.00	0.00	100.00
Eight	23	2	15	6	14	9	6	17	0	0	23
	6.61	1.46	11.72	7.23	6.70	6.47	3.49	9.66	0.00	0.00	22.33
		8.70	65.22	26.09	60.87	39.13	26.09	73.91	0.00	0.00	100.00
Nine	5	0	3	2	1	4	2	3	0	0	5
	1.44	0.00	2.34	2.41	0.48	2.88	1.16	1.70	0.00	0.00	4.85
		0.00	60.00	40.00	20.00	80.00	40.00	60.00	0.00	0.00	100.00
Ten	4	0	3	1	2	2	1	3	0	0	4
	1.15	0.00	2.34	1.20	0.96	1.44	0.58	1.70	0.00	0.00	3.88
		0.00	75.00	25.00	50.00	50.00	25.00	75.00	0.00	0.00	100.00
11	4	0	3	1	1	3	1	3	0	0	4
	1.15	0.00	2.34	1.20	0.48	2.16	0.58	1.70	0.00	0.00	3.88
		0.00	75.00	25.00	25.00	75.00	25.00	75.00	0.00	0.00	100.00

TABLE 30: Number of houshold members

		AREA OF INTERVIEW			INDOOR PIPED WATER		METERED ELECTRICTY		HOUSEHOLD SIZE		
	TOTAL	SUBURBAN	TOWNSHIP	INFORMAL	YES	NO	YES	NO	ONE-THREE	FOUR OR FIVE	SIX OR MORE
TOTAL RESPONSES	348	137	128	83	209	139	172	176	106	139	103
12	2	0	1	1	0	2	0	2	0	0	2
	0.57	0.00	0.78	1.20	0.00	1.44	0.00	1.14	0.00	0.00	1.94
		0.00	50.00	50.00	0.00	100.00	0.00	100.00	0.00	0.00	100.00
14	1	0	1	0	1	0	0	1	0	0	1
	0.29	0.00	0.78	0.00	0.48	0.00	0.00	0.57	0.00	0.00	0.97
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	0.00	100.00
24	1	0	1	0	1	0	0	1	0	0	1
	0.29	0.00	0.78	0.00	0.48	0.00	0.00	0.57	0.00	0.00	0.97
		0.00	100.00	0.00	100.00	0.00	0.00	100.00	0.00	0.00	100.00
MEAN	4.75	3.54	5.91	4.98	4.51	5.12	4.12	5.38	2.36	4.48	7.58
S.D.	2.44	1.56	2.73	2.25	2.51	2.28	1.94	2.71	0.73	0.50	2.28
Chi Square		82.62			20.49		32.25		696.00		
		p=.001			p=.084		p=.002		p=.001		

Questionnaire:

Cost to households of increased water salinity

Questionnaire outline used in qualitative surveys conducted in the Klerksdorp/Stilfontein/ Orkney and Welkom districts

Michael O'Donovan
Annalie Jooste

July 1996

Guide for interviews with "newcomer" households

NAME OF RESPONDENT _____

TEL NUMBER. _____

STATUS IN HOUSEHOLD _____

WHEN DID YOU MOVE TO WELKOM DATE _____

WHERE DID YOU LIVE BEFORE MOVING HERE _____

HAS THE STRUCTURE OF THE HOUSEHOLD CHANGED DURING/ SINCE THIS MOVE? (eg increase/ decrease in size) YES NO

IF YES PLEASE DESCRIBE THE CHANGES _____

HAS THE HOUSEHOLD EARNINGS CHANGED SINCE/ DURING THIS MOVE YES NO

IF YES PLEASE INDICATED THE PERCENTAGE INCREASE/ DECREASE IN EARNINGS: _____Percent

HAS THE AMOUNT OF MONEY THE HOUSEHOLD HAS AVAILABLE FOR THE PURCHASE OF NON-ESSENTIAL GOODS INCREASED YES NO

IF YES PLEASE ESTIMATE THE PERCENTAGE INCREASE/ DECREASE OVER THIS PERIOD. PERCENT

HAVE YOU OBSERVED ANY DIFFERENCES IN THE QUALITY OF THE WATER IN WELKOM (COMPARED TO WHERE YOU LIVED BEFORE)? YES NO

IF YES PLEASE DESCRIBE THE DIFFERENCE IN THE WATER

HAS THE BEHAVIOUR OF THE MEMBERS OF THIS HOUSEHOLD (OR ITS EMPLOYEES) CHANGED IN RESPONSE TO THE CHANGE IN WATER QUALITY. YES NO

IF YES PLEASE DESCRIBE WHAT THESE DIFFERENCES ARE:

* * * * * * * * IN AN ATTEMPT TO ANTICIPATE THE DIFFERENCES AND QUANTIFY THE COSTS WE LIST ALL THE PROBABLE ADAPTATIONS BELOW UNDER CONSUMER, DURABLE AND CAPITAL ITEMS.
PLEASE ENSURE THAT ALL COSTS -EVEN THOSE NOT REFLECTED - ARE INDICATED AND QUANTIFIED. * * * * * * * *

CONSUMER GOODS

Costs of poor water quality with respect to consumer goods is to quantified by comparing current expenditure on particular items and expenditure before the household moved. Costs can be incurred by use of more of the item, by using higher priced items of that type. The differences must be due changes in water quality and not to fashion, wealth etc. Ask respondent if the change is due to the water quality or not.

ITEM	COST BEFORE MOVE (INDICATE PERIOD)	COST NOW	% DIFFERENCE	DUE TO WATER?
WASHING DETERGENTS				Y/N
SOAPS AND SHAMPOOS				Y/N
COLDRINKS, BOTTLED WATER, etc				Y/N
FABRIC SOFTENERS				Y/N
POT DESCALERS etc				Y/N
BLEACH				Y/N
BODY CREAMS				Y/N
. . . . .				Y/N
. . . . .				Y/N
RENT, LEVY etc				
TRANSPORT				
EDUCATION				
FOOD				
ENTERTAINMENT				
CLOTHING				
WATER, ELECTRICITY				
ALL OTHER EXPENSES				

DURABLE GOODS

Durable goods include household appliances like kettles and irons. Households may replace these for different reason. Here we need to find out how often and why households replace them and how much these repairs or replacements cost. The "reasons" should reflect the nature of the breakdown. The reason why must reflect enough information to determine if the problem is caused by water quality - the respondent may not know if this is the case. If a water-related item was damaged by water quality and was not replaced or repaired obtain the estimated cost of repair/ replacement. All changes should be to items in this dwelling.

Item	Cost of repair/ replacement	Date of previous repair/ replacement or service	Reason for repair/ replacement/ service
WASHING MACHINE	R		
POTS AND PANS	R		
TAPS	R		
TAP WASHERS/ VALVES	R		
TOILET VALVE	R		
DISHWASHER	R		
DRINKING WATER FILTER	R		
POOL FILTER	R		
STEAM IRON	R		
KETTLE			
HUMIDIFIER			
CAR RADIATOR			
CAR BATTERY			
GARDEN SPRINKLER SYSTEM			
WATER SPORT EQUIPMENT			
SHOWER HEAD			
FISH TANK FILTER/PARTS			
TILES, TOILET & OTHER HOUSE FITTINGS			
SOLAR HEATER			
COFFEE MACHINE/MAKER			
GEYSER PRESSURE VALVE			
. . . . .			
. . . . .			
. . . . .			

DURABLE GOODS

Durable goods include household appliances like kettles and irons. Households may replace these for different reason. Here we need to find out how often and why households replace them and how much these repairs or replacements cost. The "reasons" should reflect the nature of the breakdown. The reason why must reflect enough information to determine if the problem is caused by water quality - the respondent may not know if this is the case. If a water-related item was damaged by water quality and was not replaced or repaired obtain the estimated cost of repair/ replacement. All changes should be to items in this dwelling.

Item	Cost of repair/ replacement	Date of previous repair/ replacement or service	Reason for repair/ replacement/ service
WASHING MACHINE	R		
POTS AND PANS	R		
TAPS	R		
TAP WASHERS/ VALVES	R		
TOILET VALVE	R		
DISHWASHER	R		
DRINKING WATER FILTER	R		
POOL FILTER	R		
STEAM IRON	R		
KETTLE			
HUMIDIFIER			
CAR RADIATOR			
CAR BATTERY			
GARDEN SPRINKLER SYSTEM			
WATER SPORT EQUIPMENT			
SHOWER HEAD			
FISH TANK FILTER/PARTS			
TILES, TOILET & OTHER HOUSE FITTINGS			
SOLAR HEATER			
COFFEE MACHINE/MAKER			
GEYSER PRESSURE VALVE			
. . . . .			
. . . . .			
. . . . .			

In conclusion we would like to ask you a few questions regarding the water in general.

What potential costs to you of the poor water quality have not been reflected in the categories above?

a _____
b _____
c _____
d _____
e _____
f _____

What do you think about the water quality in this area? With regard to:

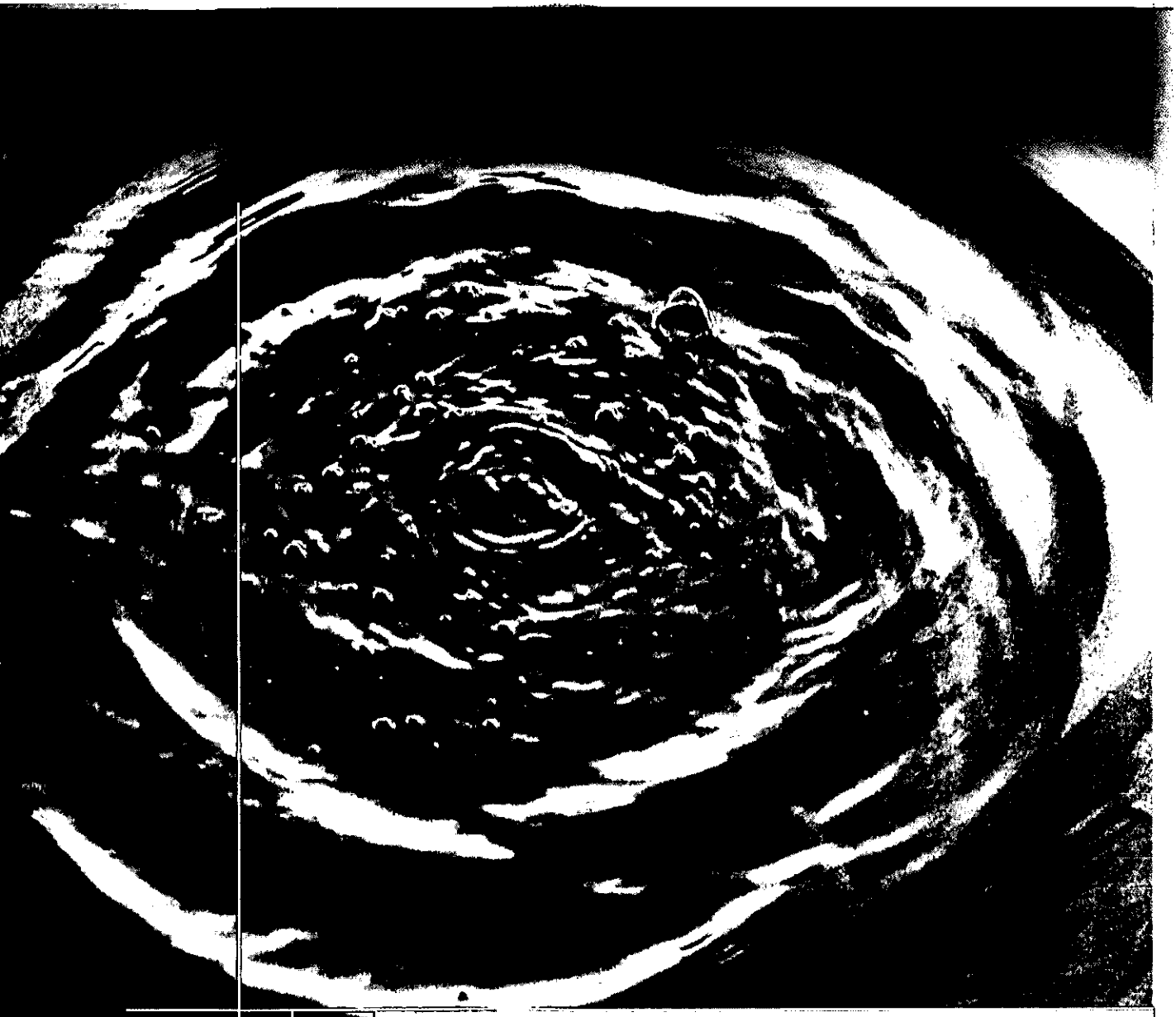
Taste/ drinking/cooking _____

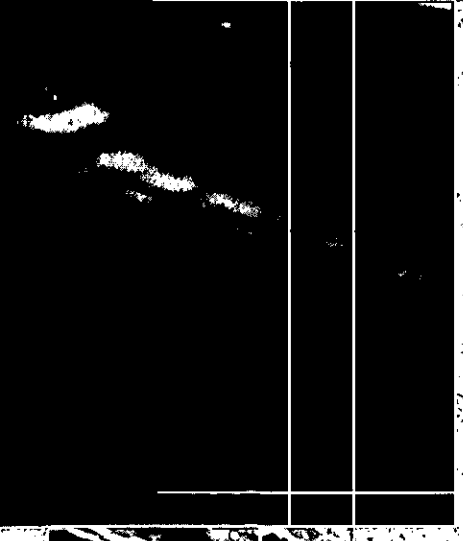
Ability to wash clothes _____

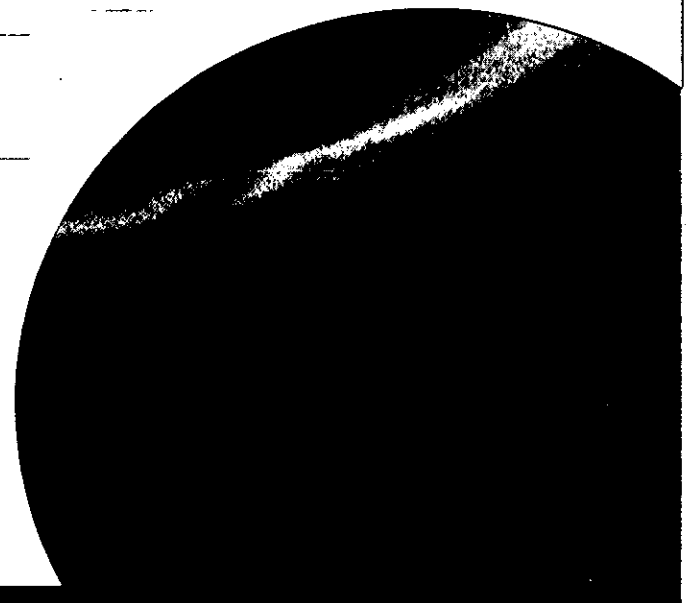
Ability to wash in: _____

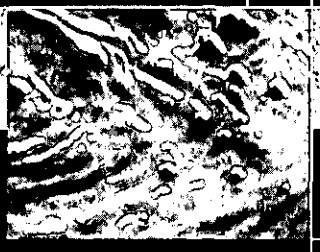
Other aspects _____

Does anybody in this household from dry skin or from itchiness after bathing? **YES** **NO**









Water Research Commission
PO Box 824, Pretoria, 0001, South Africa
Tel: +27 12 330 0340, Fax: +27 12 331 2565
Web: http://www.wrc.org.za