AWARD

Association for Water & Rural Development

ECONOMICS OF PRODUCTIVE USES FOR DOMESTIC WATER IN RURAL AREAS: A CASE STUDY FROM BUSHBUCKRIDGE SOUTH AFRICA

Juan Carlos Pérez de Mendiguren (Research Officer)
Mpatametse Mabelane (Junior Research Officer)

AWARD
P. Bag X 483
Acornhoek
1360
South Africa

RESEARCH REPORT
JULY 2001

ABSTRACT

Demand Responsive Approach (DRA) is the “new phrase” in the South African Water Supply and Sanitation sector at the turn of the century. The fundamental point of this approach is that achieving sustainable water systems at community level can only happen if people are provided with the level of service they want and are able to pay for. In other words, sustainability can be achieved by understanding and being responsive to people’s effective demand for water. Consequently, in this DRA era, a great deal of attention is being given to ensuring appropriate financial arrangements (including cost recovery mechanisms), institutional options (private sector versus public utilities), and social intermediation of community water projects (facilitation of projects and community participation). However, if the emphasis is on responding to community water demand and needs, the obvious question to ask is how well do we understand that demand?

The answer is not very well. Within the South African context, past inequalities in the access to water have also had a reflection on the amount of information available for each of the water user sectors. Our current understanding of water demand is biased towards traditional users of water (Agriculture, Forestry, Mining and Industry and the Tourism sector). Very little is known about the patterns of water use and demand in rural communities. Also, at rural domestic level, following from the assumption that drinking water is the main priority for rural people, most of the research has focused on water for human consumption. Systems have been design to provide drinking quality water and, in many cases, the cost of the water is high.

But, do these system meet demand for water in rural areas? Are there any “productive uses” for domestic water? (•vegetable gardens, •fruit trees, •livestock watering, •building, and •small businesses). How much water is demanded for these other uses? Do the “drinking water systems” provide enough water to meet this demand? Is there and effective demand for this type of water (can people afford to pay for that water)? Are there any economic benefits to this water? What happens when the system does not cater for this demand? What are the available technical options to met demand? Providing answer to this type of questions is critical for practitioners, planners and policy makers in the Community Water and Sanitation sector. It will determine their ability to understand demand and therefore their ability to respond to it.

The evidence to be presented in this report is the result of a research process undertaken by the Association for Water and Rural Development (AWARD) in 13 communities in the Bushbuckridge District (part of former Gazankulu and Lebowa homelands), Northern Province. The research results throw some light into the issues presented above. It presents evidence on the extent of productive uses for water at community level, the economic benefits (livelihood benefits) to this water and the current patterns of payment for water. It introduces some of the main issues affecting the willingness to pay for water in rural communities, and it will also discuss some of the challenges ahead for the community water sector in South Africa.

The executive summary presented here is intended to be a stand-alone document that highlights the main findings of the research. For a comprehensive analysis of each topic refers to the relevant chapter in the research report.

EXECUTIVE SUMMARY

CHAPTER 1: INTRODUCTION

This chapter the policy background to the research, the objectives and research questions and provides a general description of the study area.

POLICY BACKGROUND

The following water policy documents are reviewed in this chapter:

- The White Paper on Water Supply and Sanitation
- The Water Services Act (Act 108 of 1997)
- The White Paper on National Water Policy
- The Water Act (Act 36 of 1998).

RURAL WATER SUPPLY AND SANITATION SECTOR IN SOUTH AFRICA

In rural areas, water sources are used for a combination of *consumptive* (basic needs) and *productive* purposes. The former refers to water used for human consumption (drinking, cooking, personal hygiene, and household cleaning). The latter refers to low-*level economic activities* that are highly dependent on the availability of secure and reliable water supplies. Vegetable gardens, cattle farming, traditional beer making, hair salons and brick making, are some examples of the uses of water for income generation.

Most of the research at the rural domestic level has focused in water for human consumption, to the exclusion of water related economic activities. Systems have been designed to provide drinking quality water and, in many cases, the cost of the water is high. Productive uses for domestic water are hardly ever considered when looking at planning for rural domestic supplies. Therefore, under current circumstances, the need to fill the information gaps regarding domestic water use patterns becomes a priority issue for at least two important reasons:

- Understanding domestic water use patterns and demand from a broad perspective (both for basic needs and economic activities) will improve the ability to respond to demand, the essence of DRA, and one of the important steps towards sustainability.
- As *domestic and municipal users*, previously disadvantaged communities will have to compete with the other key sectors in their quest to gain access to water over and above the *basic needs* level.

THE RESEARCH QUESTIONS

- Given the current minimum national standards for domestic supply (RDP minimum standards: 25 l/p/d within 200 metres), and current use patterns, does this minimum standard meet basic needs in rural areas?
- Are there any economic uses for domestic water? ("low level economic activities")
- How much water is used for these "economic activities"?
- What are the economic benefits generated by rural households from these activities?
- Do people pay for the water in Bushbuckridge? (Is there an effective demand for water?)
- Are people willing to pay for the water? What factors affect "willingness to pay" for water?

CHAPTER 2. RESEARCH METHODOLOGY

This chapter explains in detail the research process and the approach taken in the study. It also analyses some of the lessons learnt from experience and shares some of the concerns arising from the "researcher's" relationship with rural communities in a research environment.

METHODOLOGICAL APPROACH

A comparative village-case-study approach was used in the study. Following from institutional and climatic differences Bushbuckridge was subdivided into 6 areas: north-west, north-east, midwest, middleast, south-west, south-east. Within each area two villages of similar socieconomic and physical attributes but **diametrically opposed domestic water supply situations** were chosen. The criteria for selection are shown in table 2.1 overleaf. For the purpose of this study the villages were termed as "worst case" and "best case" scenario.

Six to seven days were spent in each of the villages over the study period. Emphasis was place on allowing the community members enough time to discuss research issues. Figure 2.1 provides an overview of the process followed at village level

Figure 2.1
Overview of the research process

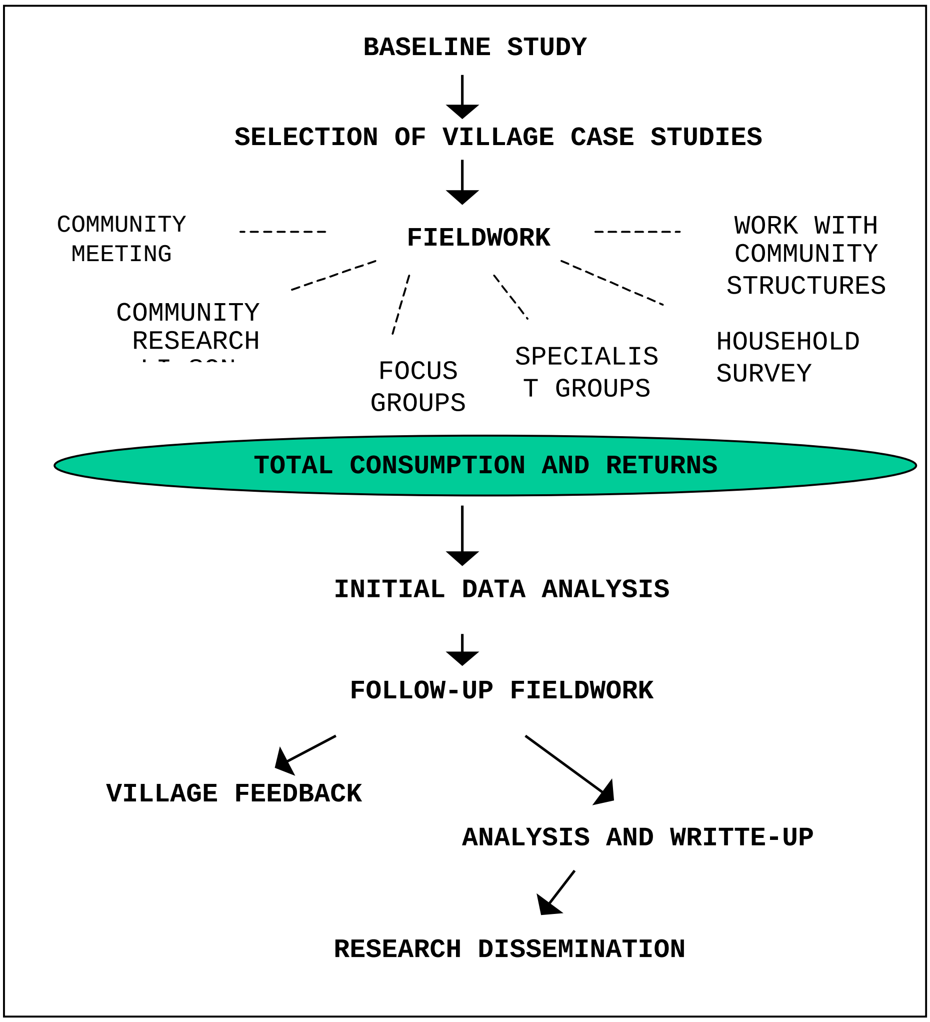


Table 2.1
Research categories and main characteristic for each category

CATEGORY	CHARACTERISTICS
"Best case scenario" villages/sections	• Functional reticulated supply. Minimum RDP standards met for all households • Most households have one or more yard taps • Very few households have in-house connections. • Water supply is very reliable • Yard tap is the highest level of service
"Worst case scenario" villages/sections	• No reticulated supply in the village (or non-functional). • Minimum RDP standards are not met for all households • Large differences in the level of service between households • People walk long distances and queue to fetch water • Supply is very unreliable and people face long periods without water. • Most households suffer severe shortages of water. • Private vendors are common • Community tensions arise due to differences in access to water

CHAPTER 3. DOMESTIC USE OF WATER FOR BASIC NEEDS

The question :

Given the current minimum national standards for domestic supply (RDP minimum standards: 25 l/p/d within 200 metres), and current use patterns, does this minimum standard meet basic needs in rural areas?

Figure 3.1
Mean consumption for Basic Needs in both research categories (l/p/d)

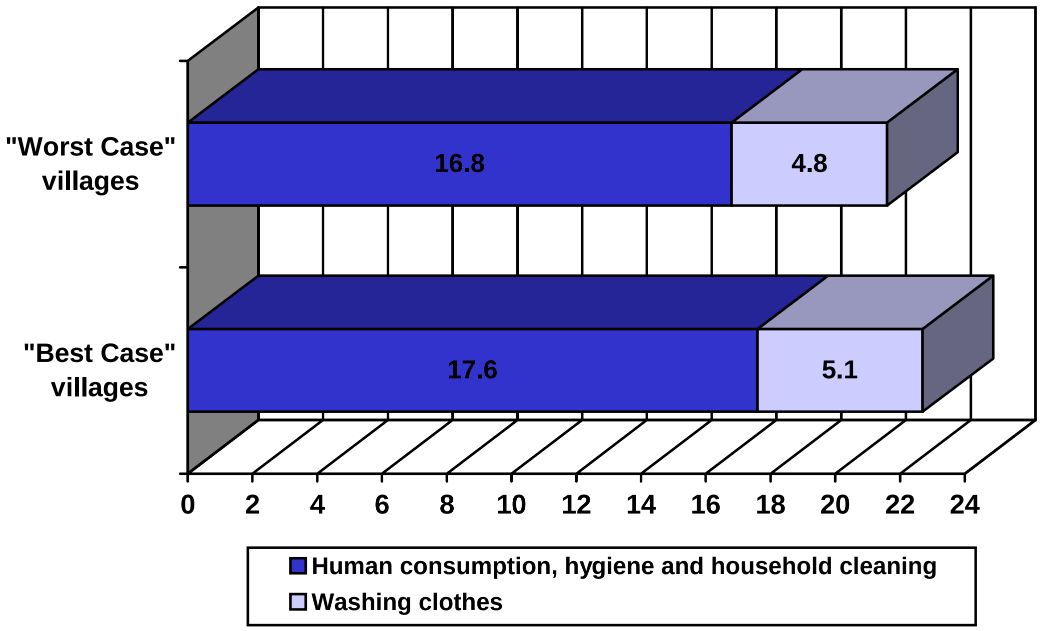


Figure 3.1 summarises the results for both types of villages considered in the research.

- Research results presented here indicate that, where the maximum level of service is a yard tap, under current consumption levels **basic human needs are covered within the first 25 litres/capita/day**

- An average of 16 to 17 l/p/d are used for human consumption, personal hygiene and household cleaning, whereas an average of 5 l/p/d are used for washing clothes.

- Although the figures seem to indicate that basic consumption of water is somewhat higher in "best case" villages, these differences are not statistically significant. There may be due to the variability of consumption between households in the each of the villages, and not to the difference in supply between "best" and "worst" case scenario villages.

- **Consumption increase dramatically with levels of service higher than a yard connection**, particularly if the household has access to shower/bath and water-borne sewerage systems, and the service is provided at no cost to the consumer.

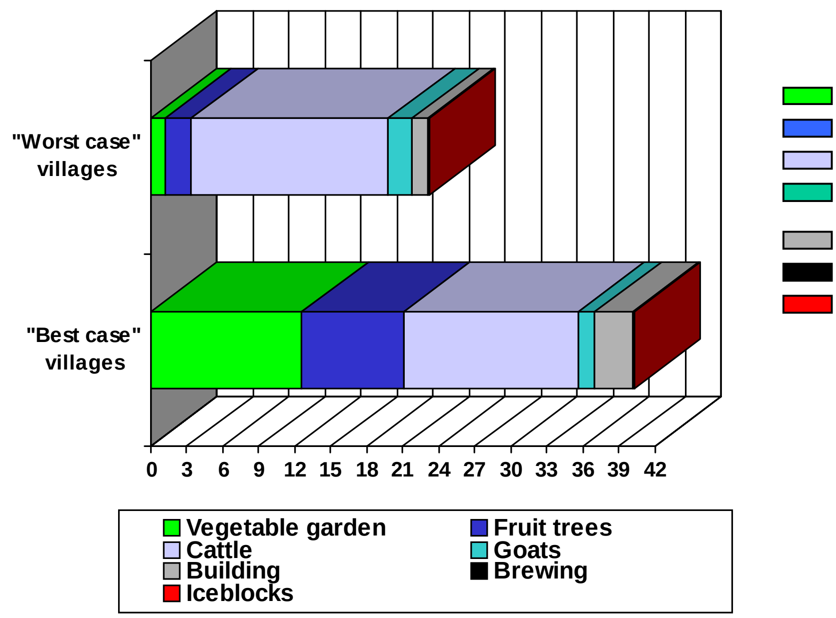
CHAPTER 4. USE OF DOMESTIC WATER FOR ECONOMIC ACTIVITIES

The question:

What the main productive uses for domestic water?
How much water is used for these "economic activities"?

Seven activities were identified as the main productive activities that currently make use of domestic water, these are: Vegetable gardens, fruit trees, making bricks for building, brewing traditional beer, making ice-blocks, hair salons and livestock rearing.

Figure 4.4
Summary consumption for all "low level economic" activities in "best cases" versus "worst cases (l/c/d)



Best	Worst
12.6	1.2
8.5	2.2
14.5	16.4
1.4	2
3.1	1.3
0.09	0.05
0.12	0.12
40.4	**23.3**

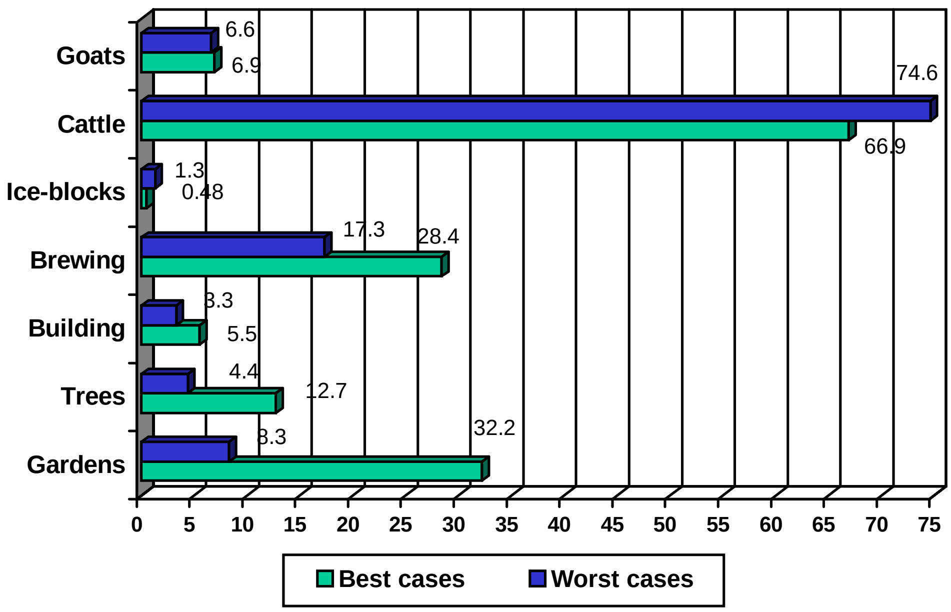
- Figure 4.4 summarises the average water consumption for all 'low level economic activities'. For each village, these figures take into account the total number of people involve in each activity and average their consumption across all households, regardless of whether they are involved in the activity or not. Therefore, the figures presented here provide an estimation of the amount of water that is needed in the village to support the current level of productive activities.

- The main conclusion from these figures is that all **economic activities using domestic water occur over and above the first 25 litres** (basic needs)**. An additional 25 to 40 l/p/d** will be needed to support these economic activities (given current proportion of household involved in the activities and water consumption). The activities using most water are cattle ranging, vegetable gardens, beer brewing and watering trees.

- Also, the comparisons between consumption in "best case" and "worst case" villages provide an indication of the likely increase in water consumption with improved water supplies. Water consumption for all activities except for ice-blocks, is much higher in best case villages. The most important increases occur in the irrigation of gardens (950%), irrigation of fruit trees (286%), building activities (138%) and beer brewing (80%).

- However, as they are averages for all households, the figures above do not reflect the real amount of water used by a household involved in a particular activity, being the amount required for each activity much higher than the above average. Figure 4.1 provide average consumption figures for each activity, when only those households that engage in the activity are considered.

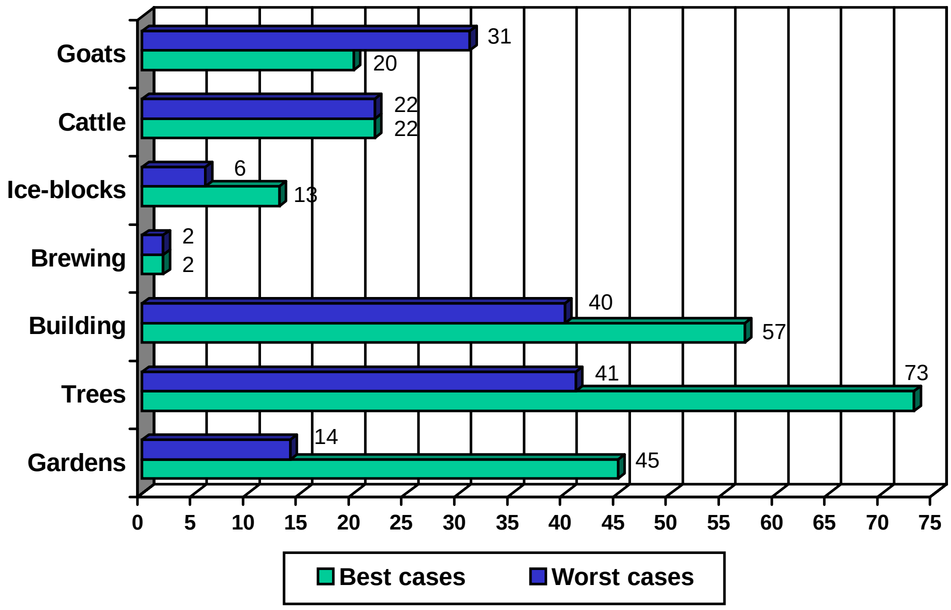
Figure 4.1
Water consumption per business in households involved in the business (L/c/d)



- Finally, figure 4.2 overleaf, provide an overview of the average level of involvement of households in each of the activities. Not all households engage in "low-level economic activities". In "best case" villages, the proportion of households involved in each activity range from 2% of the households for beer brewing to 73% for the irrigation of fruit trees. Moreover, for most activities, the proportion of households involved is also higher in "best case" villages than in "worst case villages".

.

Figure 4.2
Percentage of households involved in each activity (%)



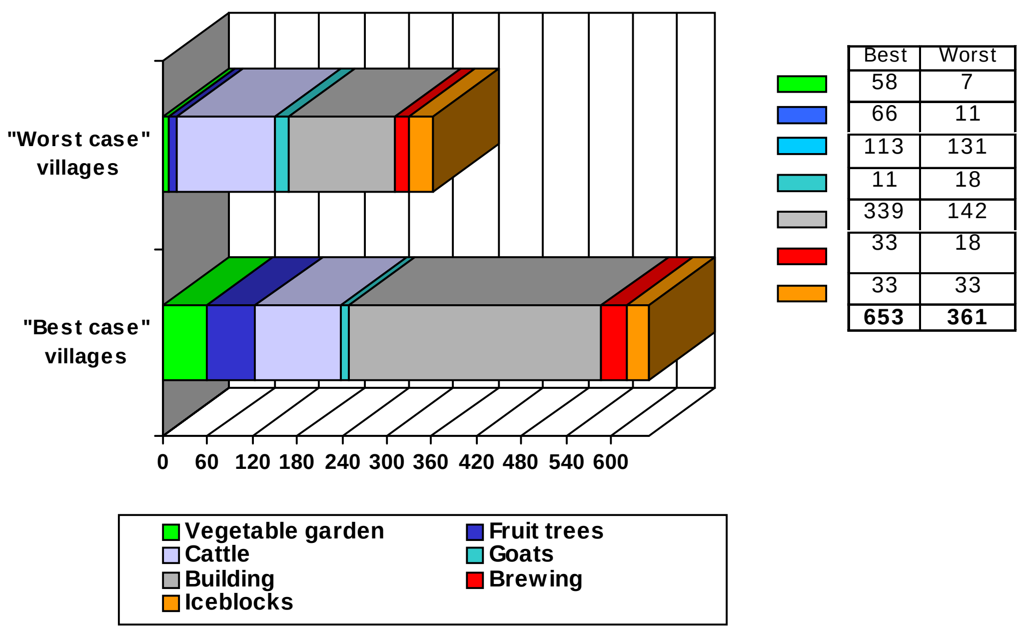
CHAPTER 5. RETURNS TO ECONOMIC USES OF DOMESTIC WATER

The question:

What are the economic benefits generated by rural households from these activities?

The economic significance of water based activities is measured by looking at the income generated from each activity using "gross margins" figures per activity, and per litre of water.

Figure 5.4
Total gross margins from "low level economic activities" in the two types of villages (all activitites) (R/capita/year)

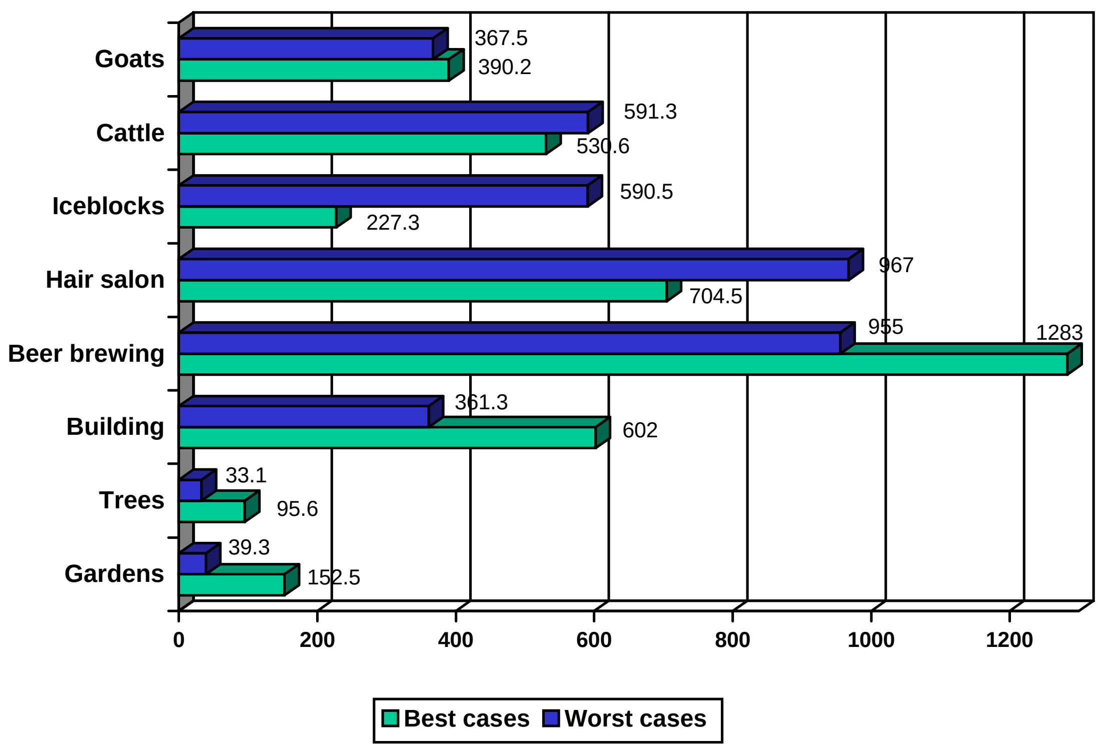


- Figure 5.4 summarizes the returns from all 'low level economic activities' in both types of villages. This income reflects an average value for all activities when estimated across all households, regardless of whether each household engages in the activity or not (under current proportion of household involvement and water consumption).

- Total income generated from 'low-level economic activities' **averages R529 to R653 person/year.** In other words, these are the total benefits generated from the 25 to 40 l/p/d used for productive purposes. Also, the comparisons between consumption in "best case" and "worst case" villages provide an indication of the likely increase in income derived from improved water supplies.

- For the same reasons cited in the previous section, the figures above do not reflect the real income generated by a household involved in a particular activity, being this income much higher than the above average. Figure 5.1 provide average "gross margin" figures for each activity, when only those households that engage in the activity are considered.

Figure 5.2
Annual gross margins per capita for those involved in each activity (R/capita/year)

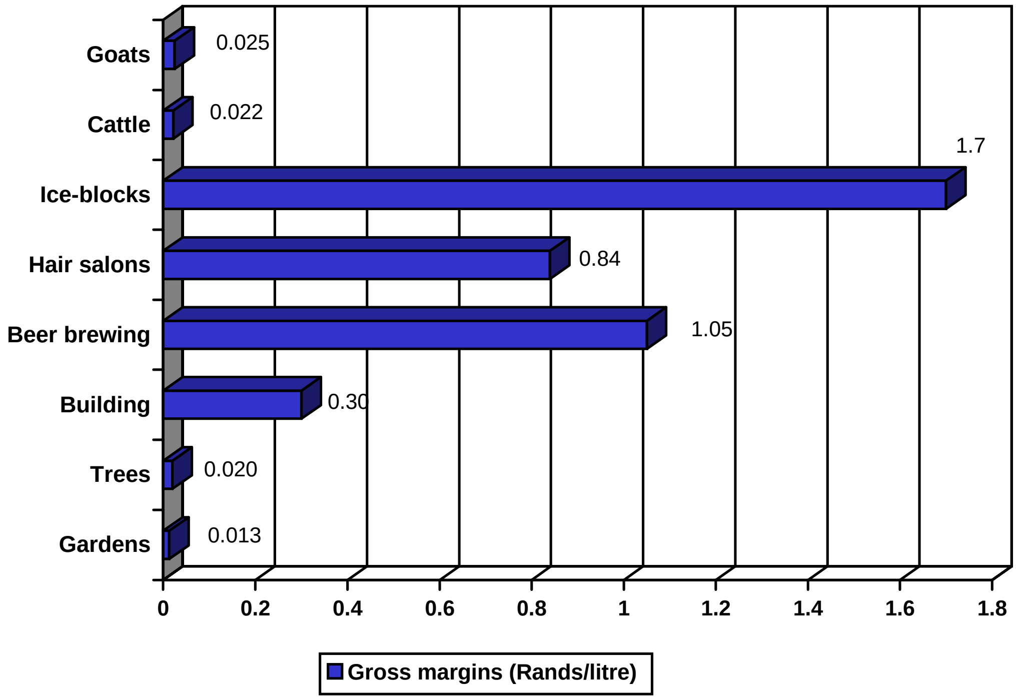


- Additionally, figure 5.2 overleaf, provide an overview of the "gross margins" for all activities. They show a wide variation across businesses. Ice-block making provide the highest return (1.7 R/l) followed by beer brewing (1.05 R/l) and hair salons (0.84 R/l). Fruit trees (0.02 R/l) and vegetable gardens (0.013 R/l) provided the lowest returns

- The highest rates of involvement in "low-level economic activities" are for those activities with the lowest returns per litre of water. This is the case for fruit trees and vegetable gardens. In contrast, beer brewing and ice-block making activities providing the highest returns per litre, have the lowest rate of households involvement. Reasons for this are provided in chapter 5 and 7.

,.

Figure 5.1
Gross margins for " water-dependent low-level economic activities"
(R/litre)



CHAPTER 6. PRICES AND PAYMENT FOR WATER IN BUSHBUCKRIDGE

The questions:

Do people pay for the water in Bushbuckridge? (Is there an effective demand for water?) What factors affect "willingness to pay" for water?

- That rural inhabitants do not pay for water cannot be assumed in general. Evidence from Bushbuckridge indicates that the opposite may well be the case, and prices paid by rural households can be much higher that prices paid in areas where proper cost-recovery mechanisms are in place.

- The second assumption that needs to be revised is that poor people cannot pay for water. Whereas low affordability is a reality for many rural households evidence shows that it is likely that the poorest people in the Bushbuckridge area are facing the highest prices for water.

- Nevertheless, the issue of affordability needs to be separated from that of having to pay and how much. The two are different questions and the evidence showing that poor people can and do pay for water should not imply that the priority for the sector is to make poor people pay for water.

- The fact that rural people are paying the highest prices for water indicates that there is room for manoeuvre. In some cases, where the need for payment for water is justified, implementing a formal payment system with tariffs reflecting local conditions and choice of level of supply can improve the situation of the poorest (some degree of cross subsidization is possible)

- Reasons why people decide not to pay for water are complex and in many instances can not be attributed to a single cause. Understanding these reasons and perceptions must become a priority for policy makers and water service providers due to the potential effects on cost recovery and ultimately on project sustainability. Failure in water project is too often attributed to low affordability (ability to pay) when the real reason are more to do with “low willingness to pay”.

CHAPTER 7. LESSONS CONCLUSIONS AND POLICY ISSUES

This chapter discusses in detail the main lessons learnt from the research and highlight some relevant policy issues. These are:

- For the Bushbuckridge area, there is enough evidence to inform the allocation of water for the human reserve using the figure of 25 l/p/d as the minimum amount required to meet basic human needs.

- The main challenge now remains as to how to make this concept operational. Research need to be put into the design and implementation of appropriate allocation mechanisms from the technical, institutional and economic perspective so as to ensure sustainable access to domestic water both for present and future generations.

- Water-based activities play an important role in rural livelihood systems in Bushbuckridge. The inability to access domestic water for economic purposes can reduce considerably the livelihood options for poor people in the area. How these water-based livelihoods feature in the overall livelihood strategies for rural households should be the focus of further research.

- Furthermore, the lessons learnt from this research are very relevant for RWSS sector, given the growing concerns about cost recovery and **sustainability**. The ability of the rural poor to access increasing amounts of water quantities will not just be determined by the availability of the water (supply side) but mainly by their ability to carry the costs of the water and its supply (effective demand / ability to pay). The ability to pay, in turn, can only be enhanced by increasing the economic opportunities of the rural poor, and as we have seen before, **accessing water for productive uses (over and above the basic needs (25 l/c/d) may be a necessary precondition for this.**

- In other words, the rural water sector policy should not only be driven by the supply of “basic needs” but also by the economic opportunities that the access to additional water can generate in rural areas. Unfortunately, despite the growing interest about the importance of water for rural livelihoods, the Department of Water Affairs & Forestry (DWAF) still has no mechanism for allocating water to this sector, nor is it formally incorporated in any water balance models.

- Alternative ways of providing water for productive uses need to be explored. In some circumstances, providing this water through current domestic water systems may not be most effective way (see experience with collector wells in Zimbabwe, in Lovell 2000). Some creative thinking will be needed from engineers and technical experts in order to provide solutions that are appropriated to the South African context.

- Finally, the provision of water for productive uses needs to be done without compromising the provision of basic needs. Evidence from India indicates that, in the context of a dramatic increase in groundwater extraction for small-scale irrigation during the last ten years, domestic water supplies are becoming increasingly threatened as a consequence of groundwater depletion and increasing demand. (Batchelor et al. 2000)

TABLE OF CONTENTS

3. DOMESTIC USE OF WATER FOR BASIC NEEDS

4. USE OF DOMESTIC WATER FOR ECONOMIC ACTIVITIES

5. RETURNS TO ECONOMIC USES OF DOMESTIC WATER

6. PRICES AND PAYMENT FOR WATER IN BUSHBUCKRIDGE

7. LESSONS, CONCLUSIONS AND POLICY ISSUES

SUMMARY LIST OF TABLES

CHAPTER 5

CHAPTER 6

SUMMARY LIST OF FIGURES

SUMMARY LIST OF APPENDIXES

CHAPTER 3

CHAPTER 4

CHAPTER 1
INTRODUCTION

1.1 RESEARCH BACKGROUND

1.1.1 The international debate on Water Supply and Sanitation

The 1980s showed a major shift in the way most governments approached Water Supply and Sanitation interventions. The traditional approach centered around the perceived health benefits of improved water supplies to the population and did not take into account the specific needs, circumstances, and constraints of most communities. It did not consider the involvement of the beneficiaries in deciding on the way systems operate, the quantity and quality of water delivered, and the conditions under which projects would become a success. It simply assumed that the beneficiaries would take care of the system and/or that the government would commit increasing amount of funds to operation and maintenance of existing systems and the construction of new ones. Government intervention focused on systems based on prescribed needs. Little consideration was given to the management of the resource base and the scarcity of water resources that countries such as South Africa had to face. This traditional approach has been referred to in the literature as the Supply-Dominated or Supply Driven Approach (Black,1998; Garn 1998; DWAF,1997).

The beginning of the 1990s saw a shift to a new approach that stressed the consideration of water as an economic good and the importance of demand as the driving force in the Water and Sanitation sector. It was accordingly named the Demand-Driven or Demand Responsive Approach (DRA) (Sara, 1998; Garn 1998; Dreyer 1998) and is based mainly on two principles that were endorsed at the 1992 International Conference on Water and the Environment in Dublin. These were:

- Water is an economic, as well as a social good and should be managed as such
- Water should be managed at the lowest appropriate level, with users involved in the planning and implementation of projects.

The implications on this new approach for the water sector are far reaching. It focuses its attention on consumer demand, that is, the quantity and quality that consumers want at a given price. It requires that managerial decisions about the levels of service, location of facilities, cost recovery and O&M should be made responsive to local needs as defined by the clients (community members in the case of community water supplies). .

The international debate and the shift towards DRA has coincide in South Africa with a changing policy environment arising from the effort of the new democratic government to address inequalities brought about by the apartheid regime. These two trends have had a profound repercussion in the Rural Water Supply Sector and together provide the general context for this research.

1.1.2 The South African context

1.1.2.1 Legislative and policy framework

THE WHITE PAPER ON WATER SUPPLY AND SANITATION (WPWSS) AND THE WATER SERVICES ACT

At the end of 1994 the Department of Water Affairs and Forestry (DWAF) published the WPWSS (RSA DWAF,1994). This paper marked the inception of a new policy for the water sector in the context of the post-apartheid South Africa and provided a framework to ensure that "all South Africans have the right to access to basic water supply and sanitation". The WPWSS defines basic water supply as the access to 25 litres per person per day within 200 metres of each household. This level of supply is considered to be the minimum required for direct consumption, the preparation of food and for personal hygiene. However, it is not deemed adequate for a full, healthy and productive life, and therefore, the White Paper indicates that during planning the desire of many communities to upgrade from a basic service to a household connection should be considered

The Paper also provides a general policy framework for the financing of the new policies and developments in the water sector. In this context, even though financing of water infrastructure in rural areas is given high priority, the WPWSS states that *"…services should be self-financing at a local and regional level. The only exception to this is that, where poor communities are not able to afford basic services, Government may subsidise the cost of construction of basic minimum services but not the operating, maintenance and replacement costs."* (ibid.) Hence, for higher levels of service, communities would have to carry the extra costs.

The White Paper also refers to the setting of tariffs and the adoption of equitable tariff systems. It acknowledges that in the past water was provided free of charge in many areas whilst in others the poor were subsidising the rich. The White Paper indicates that *"…the policy of the Department is that all consumers must contribute to their water supplies. In poor communities which are unable to afford to pay both the construction and operation costs of the schemes provided by government, a social tariff (life-line tariff) covering only the operating expenses will be charged for the minimum level of service, which is a communal water source. For higher levels of service, the full cost of supply will be charged."* (ibid.)

In 1997, the Water Services Act (Act 108 of 1997) was passed. This framework act ensures that everybody has access to basic water supply and sanitation services necessary for the human health and well being. It also allows for the setting of national standards and norms for water services and tariffs, and clarifies the institutional framework for the provision of water services.

THE WHITE PAPER ON NATIONAL WATER POLICY (WPWNP) AND THE WATER ACT

In April 1997, the WPNWP was gazetted (RSA DWAF, 1997). It expressed the commitment of the new South African government to address past inequalities in the access to water, but it also recognised that South Africa is a semi-arid country with limited water resources that require management to ensure sustainability. Hence, the White Paper emphasised on water resource conservation and demand management.

The WPNWP confirms the status of SA´s water resources as a national asset, regards the role of the Government as their custodian, and it introduces some important issues that are particularly relevant to this research:

- **The Reserve:** The reserve is defined as the amount of water required to meet basic human needs (human reserve) and maintain environmental sustainability (ecological reserve), and it is stated that it will be guaranteed as a right. In terms of the human reserve what this means is that access to 25 litres of water per person per day will be guaranteed.

- **Water allocation:** The WPNWP identifies the main competing user groups for water resources namely, agriculture (both irrigated and rain-fed agriculture), forestry, industry, domestic and municipal users, and recreational and eco-tourism. It establishes that allocation of water to these users over and above the reserve will be based on both optimum use and equity. Therefore, the White Paper moves away from allocations based only on the highest value user and makes an attempt to incorporate factors such as historical disadvantage and equity. The main unanswered issue is how will equity and social value be balanced against the economic value of water use?

- **Need to improve information:** The WPNWP recognises the need for a good understanding of water use in each sector. This will allow the design of appropriate programmes to promote better utilisation.

These guiding principles were legally sanctioned in 1998 with the passing of the new Water Act (Act 36 of 1998)

1.1.2.2 Rural Water Supply and Sanitation sector in South Africa

South African Rural Water Supply and Sanitation has undergone a radical change epitomised by the shift to DRA, and sustainability. DRA is the "new phrase" in the South African Water Supply and Sanitation sector at the turn of the century. The fundamental point of this approach is that achieving sustainable water systems at community level can only happen if people are provided with the level of service they want and are able to pay for. In other words, sustainability can be achieved by understanding and being responsive to people's effective demand for water.

Consequently, in this DRA era, a great deal of attention is being given to ensuring appropriate financial arrangements (including cost recovery mechanisms), institutional options (private sector versus public utilities), and social intermediation of community water projects (facilitation of projects and community participation). However, if the emphasis is on responding to community water demand and needs, the obvious question to ask is how well do we understand that demand?

The answer is not very well. Past inequalities in the access to water are also reflected in the amount of information available about each sector's water demand and use. Government policies during apartheid South Africa not only followed the logic of the Supply Driven Approach but also incorporated a paternalistic and racist component to the provision of water to South African people. The assumptions of the traditional approach were reinforced by: urban bias; a preference for white farmers; socio-political divisions based on race; and by the notion that black South Africans were unable to make decisions about their own lives. The result is that current knowledge is flawed in its focus on formal water users, namely: irrigated agriculture, forestry, industry, mining, recreation and ecotourism, and does not take into account informal activities.

Furthermore most of the research at the rural domestic level has focused in water for human consumption, to the exclusion of water related economic activities. Systems have been designed to provide drinking quality water and, in many cases, the cost of the water is high. Productive uses for domestic water are hardly ever considered when looking at planning for rural domestic supplies.

However, in rural areas, water sources are used for a combination of *consumptive* (basic needs) and *productive* purposes. The former refers to water used for human consumption (drinking, cooking, personal hygiene, and household cleaning). The latter highlights the fact that in rural areas people engage in low-*level economic activities* that are highly dependent on the availability of secure and reliable water supplies. Vegetable gardens, cattle farming, traditional beer making, hair salons and brick making, are some examples of the uses of water for income generation.

Therefore, under current circumstances, the need to fill the information gaps regarding domestic water use patterns becomes a priority issue for at least two important reasons:

- Understanding domestic water use patterns and demand from a broad perspective (both for basic needs and economic activities) will improve the ability to respond to demand, the essence of DRA, a one of the important steps towards sustainability.

- As *domestic and municipal users*, previously disadvantaged communities will have to compete with the other key sectors in their quest to gain access to water over and above the *basic needs* level. If the allocation mechanism brought about by the Water Act is to be based on a fair competition between the different sectors, a better understanding is needed of the economic uses of water in rural areas, the water demand and payment patterns generated, and the role that water plays in supporting rural livelihoods. This information will support formerly disadvantaged communities when arguing their case for water.

1.2. THE RESEARCH FRAMEWORK

1.2.1 The inception of the research

The Association for Water and Rural Development (AWARD)- a rurally based NGO, has been working directly with rural communities in the Bushbuckridge area since 1993. Bushbuckridge falls in the border between the Mpumalanga and Northern Province (South Africa), and concentrates most of the population within the Sabie-Sand Catchment area. The main focus of AWARD's work has been to support formerly disadvantaged communities in their efforts to secure access to sustainable water supply systems and therefore, the AWARD team has developed an understanding of the context in which domestic water is used in these communities.

Also, from extensive consultation about water resource of the Sabi-Sand River Catchement[1] the following key gaps in current knowledge were identified:

- An understanding of the usage, demand and payment patterns in the area (former homeland rural areas)
- An understanding of the economic uses of water in the catchment

[1] Mike Muller (DWAF), Salim Fakir (IUCN), Theo van Niekerk (DBSA), Linda Newman (Rand Water), Candice Pearlmann (Wits University, Department of Economics)

- An analysis of the land and water resource use in the catchment, the likely socio-economic developments and its implications for the water demand, or the inhibiting effect of lack of water security.
- An economic analysis of water usage by the different competing sectors on which resource use policy and allocations can be made.

With the situation of the rural water supply in South Africa as a general context and following from the key gaps in current knowledge for the Bushbuckride area, the above issues led to the need for detailed research in the areas of water use and demand. The research was conducted from the perspective of the rural people in the area and had the following objectives:

1.2.2 Research objectives

- Provide information on domestic water use, payment patterns and economic returns to water.
- Provide information to input planning and management of water resources in the area
- Support the information needs of local stakeholders (communities, and local government) in order to argue the case for improved water supplies for Bushbuckridge
- Bring the case for a better understanding of the use of domestic water in rural areas, particularly the economic use of water, into the national agenda for the Rural Water Supply Sector.
- Provide information for the development of appropriate policy for rural water supply.

1.2.3 The research questions

- Given the current minimum national standards for domestic supply (RDP minimum standards: 25 litres/capita/day within 200 metres from the household), and current use patterns, does this minimum standard meet basic needs[2] in rural areas?

- Are there any economic uses for domestic water? ("low level economic activities")[3]

- How much water is used for these "economic activities"?

- What are the economic benefits generated by rural households from these activities?

- Do people pay for the water in Bushbuckridge? (Is there an effective demand for water?)

- Are people willing to pay for the water? What factors affect "willingness to pay" for water?

1.2.4 Guiding principles

The research was guided by the following principles that are consistent with AWARD's approach to working with communities in Bushbuckridge:

- *Participatory research*. The research team would seek to involve the relevant stakeholders at all stages of the process. The main stakeholders identified were community structures, community members, DWAF officials and Transitional Local Government.
- All the data and information gathered to be *fed back to stakeholders* for their use in policy formulation and/or lobbying activities

[2] For the purpose of this research "Basic Needs" is defined as: Water for drinking, cooking, personal hygiene, household cleaning, washing clothes. See definitions

[3] Water dependant "Low level economic activities": Economic activities undertaken by households using domestic water available to them (vegetable gardens, fruit trees, livestock, beer brewing, building, ice-block making)

- Research activities and outputs to also have *intrinsic usefulness* to AWARD's core activities and support the information needs of the different programme components

1.2.5 Research foci

- **Domestic issues:** The research concentrates on domestic dynamics. The industrial sector, tourism, agriculture and forestry are not analysed in the context of this research[4]. Economic activities analysed are those that rely on **domestic water** as an input in the production process. Domestic water is defined, for the purpose of the research, as the water available for use in the homestead area (physical buildings and variable amount of land around it normally fenced off). This water is normally available from reticulated supply systems, communal standpipes, nearby streams, dams, springs, and it is carried home by household members or bought from local vendors.

- **Rural focus:** The research concentrates on rural domestic water supply use and the economics of it. Some information is provided on the use of water in one of the Township in the areas. However, this information is only used to illustrate rural/urban differences in so far as domestic water consumption is concerned. An in-depth analysis of urban dynamics in the area was out of the scope of the study.

- **Water dependent economic activities.** Even though rural households engage in a broad spectrum of "low level economic activities" (street side cooked food business, small shops know as "spaza", panel beating, backyard mechanical services…) the research only concentrates on those that require water as a main input.

1.2.6 Scope of work

Consequently, the AWARD team designed a six-stage approach to the research. Table 1.1 details the specific objectives of each phase

Table 1.1
Staged approach to the research

Phase I	**Contextual background information**
	• Gather and review relevant literature • Extensive consultations
Phase II	**Methodology development and work programme**
	• Design the methodology and test • Establishment of a "think-tank" group to critique the research
Phase III	**Fieldwork: Microeconomics of water use amongst communities in Bushbuckridge**
	• Patterns of water usage at different levels of provision • Economic uses of water • Returns on different usage • Payment patterns and actual experience of payments
Phase IV	**Feed-back to communities and local stakeholders**
	• Feed-back report and discussions to all case study communities • Feed-back report to Local Government and local DWAF officials
Phase V	**Dissemination process**

[4] For those interested in inter-sectoral comparisons, see Pollard et al. (1998)

	• Regional, national and stakeholders • Introduce issues in the national policy agenda • International conferences and discussion groups

1.2.7 Limitations

- The research concentrates on the economic uses of domestic water. The results illustrate current consumption patterns for domestic water in Bushbuckridge. Even though similar trends are likely to occur in other rural areas of the country, extrapolation of the figures to other rural areas have to be taken with caution.

- The research does not analyze all the different factors influencing demand for domestic water in rural areas. Water demand is normally a function of factors such as household size and structure, housing type, education, income, expenditure patterns, asset ownership, sanitation facilities, water price (tariffs), water quality, access to water and others. The research does not analyze the way in which each of the previous factors influence water consumption. It compares the water consumption patterns of households in villages with different situations regarding access to domestic water. The emphasis is therefore on the range of activities that became available with increasing amounts of domestic water as defined in for the purpose of this research.

1.2.8 The research team

Co-ordination of this research fell within AWARD's environmental support component. J.C Perez de Mendiguren was the overall co-ordinator of a team that included initially M.Mabelane as the junior research officer. C.Phiri replaced the latter after the completion of the fieldwork and initial data analysis. Members of the Community Support component (P.Sekgobela, C.Mhlanga, S.Mlambo and S. Mashego) helped with the facilitation process at different stages of the research. Other members of AWARD's team assisted on the analysis of the data and the review of the different chapters and articles coming out of the research. Different village structures facilitated the process of gathering the data, monitored the process and criticised the results. Community members from the 13 case study villages involved in the research participated in the innumerable interviews and group discussions in which the data was collected and analysed.

1.3 THE STUDY AREA

This section provides a very brief overview of the biophysical and human characteristics of the Bushbuckridge district (BBR). Extensive details for the entire district are provided by Shackleton et al (1995). Detailed information on the northern and midland areas of BBR, falling within the Sand River Sub-catchment, is also given in Pollard et al (1998).

1.3.1 Location

The study area for the research was the Bushbuckridge district (BBR). The Bushbuckridge district (31^{o} 0'E - 31^{o} 35'E and 24^{o} 30'S - 25^{o} 0'S), is located in the South African lowveld, in the border between the Mpumalanga and Northern Provinces. Covering an area of 240 km^2, Bushbuckridge is roughly bounded by the Orpen Road in the north, conservation areas in the east, the Drakensberg mountains in the west and the Sabie River in the South (see figure 1.1). The Sand and the Sabie are the major rivers flowing through Bushbuckridge. The Sabie River Catchment covers some 7 096 km^{2,} of which the Sand River sub-catchment as the major tributary constitutes 1910 km^2. The Sabie River Catchment, in turn, forms part of the Incomati system, an international drainage system that straddles a number of political boundaries- South Africa, Swaziland and Mozambique.

1.3.2 Climate

BBR falls within the Eastern Transvaal Middleveld and Loweld climatic region with warm to hot sub-tropical climate. The climatic conditions are strongly influenced by the topography and somewhat cooler, wetter conditions prevail along the Drakensberg. Mean annual precipitation (MAP) for the district is 600 mm, with about 65% of the district receiving less than this. A rainfall gradient from west to east, and to a lesser extent south to north, exist across the study area. The western portion of the Bushbuckridge district, adjacent to the Drakensberg escarpment, receives over 1000 mm per annum, whilst the eastern lowlands close to the border with Kruger National Park have an MAP of approximately 500 mm. Rainfall concentrates during the summer months (October to March), cyclical droughts are a common feature in the district. In the northern part of the district drought occurs as often as every 3.5 years (Shackleton et al. 1995).

1.3.3 Soils and Vegetation

The granitically derived soils and associated gently undulating topography has produced the characteristic catenal sequence of soils and vegetation found in many semi-arid savanna systems. Downslope movement of clay particles and bases has resulted in shallow, sandy, nutrient poor soils on the ridgetops; whilst bottomland soils are relatively deeper, clayey and nutrient rich (Shackleton et al 1995).

Within the Sabie River catchment area approximately 42 % of soils are suitable for irrigation. Water availability rather than lack of arable soils is thus the major limiting factor for irrigated agriculture in the catchment (Chunnett, Fourie & Partners 1990). Regionally, about 10 - 15 % of soils are suitable for irrigation (DBSA 1989).

Regarding vegetation types, the area is broadly classified as semi-arid savanna and is characterised by a mixture of trees, shrubs and grasses. Woody species distribution and density is influenced by the catenal sequence, such that low lying sites are characterised by microphyllous thorny species and broad-leafed species occupy the ridgetop regions. In common with other semi-arid savanna systems, vegetation production and recruitment is highly variable from year to year in response to variation in rainfall, the major ecosystem driving variable (Shackleton et al. 1995).

1.3.4 Land use and demography

Table 1.2 presents land-use figures for the entire Bushbuckridge district (former Mhala and Mapulaneng), based on 1986 maps.

Table 1.2
Land use in the BBR district

	LAND AREA IN HECTARES	
Total Land	241 684	%
Dryland Farming	16 101	6.6
Irrigated Farming	5 278	2.2
Grazing	156 443	64.7
Forestry	26 206	10.8
Nature Conserv.	31 000	2.8
Non Agric.	6 656	2.8

Source: DBSA 1990

There are three primary land-uses in the area. In the western part of the district, along the Drakensberg foothills, plantation forest of pines and gums constitute 10.8% of the total area of Bushbuckridge. The central part of the region is mainly under communal tenure and agriculture (8.8 %) and livestock farming activities (65%) coexist with numerous human settlements. Population density in this central region is approximately 303 people km^{-2} (calculated from 1996 census figures provided by Statistics South Africa). Livelihood options for inhabitants of Bushbuckrigde include limited access to irrigated agriculture, dry-land farming, animal husbandry, harvesting of wild plant and animal resources and a variety of small business and informal activities. The other main land use in the area is nature conservation (2.8%). This land use is the primary one in the eastern part of the region and it includes the privately owned Sabie-Sand Game Reserve and some areas of the Kruger National Park to the SouthEast and Manyeleti Game Reserve to the NorthEast. Both these reserves are state owned.

Figures provided from the 1996 Population Census provided by Statistics South Africa show that the total population for Bushbuckridge was 543700 people in 1996 (295706 in the Mhala district and 247994 in Mapulaneng). This gives an average population density across Bushbuckridge of 225 people km^{-2} (242 people km^{-2} in Mhala and 208 people km^{-2} in Mapulaneng). There were 112627 households in the catchment. Thus, the mean household size for Bushbuckridge is 4.8.

However, as it is indicated in Shackleton *et al.* 1995, population figures for Bushbuckridge are notoriously inaccurate, and difficult to determine due to significant fluctuation *de facto* population through the year. Tollman *et al* 1995, estimated that population figures for Bushbuckridge in the 1985 census were underestimated by 19% to 32%. If the same factor were applied to 1996 census figures, total *de j*ure population for Bushbuckridge would range between 650000 and 720000 people, with an average household size of 5.7 to 6.4 people. This average size compares favourably with the average household size of 6.48 encountered in surveys conducted in the Agincourt area of Mhala (Tollman e*t al* 1995). This size also compares favourably with the average household sizes encountered in our case study villages (see chapter 3). In terms of gender composition, census figures show that 55% of the entire population is female.

1.3.5 Socio-economic attributes

As it is typical for many densely populated former homeland areas of the country, high unemployment is one of the main socio-economic characteristics in Bushbuckridge. With very limited employment opportunities in the formal sector, unemployment estimates range between 67% and 79% of the active population (15 - 64 years), with figures dropping to 40% when those still in school are not included (Shackleton *et al.* 1995). Using Census 1996 figures the estimated unemployment rate for Bushbuckridge is 40% of the economically active population[5]. When those still at school are included in the definition, the unemployment figure increases to 65% of the economically active population. Unemployment in Bushbuckridge is higher than the average for the country 34% but lower than the average rate for the entire Northern Province (46%) (Orkin, 1999). Due to the lack of employment opportunities in the area, approximately 50% of the men and 14% of the women between the ages of 25 and 58 are migratory workers (Tollman *et al.* 1995) and monthly wage remittances from these workers are the major source of income for many households.

Data from the Census 1996 shows that the mean monthly individual income for Mhala and Mapulaneng magisterial districts was R190 in 1996, with 81% of the individual earning no income and 13% of people earning between R1 and R1000. There were 8% of the people in the R201-R500 income bracket, the majority of whom are pensioners earning R490 per month. Farm

[5] Figures calculated from magisterial district data provided by Statistic South Africa. The following definition has bee used to define "Economically Active Population": Economically active refer to all those who are available for work. It includes both the employed and the unemployed. People who are not available for work, such as those under the age of 15, students, housewives, pensioners, disabled people and others who are permanently unable to work, are excluded from the definition.

workers in commercial agriculture, tourism, forestry and civil service posts such as teachers, nurses and other personnel are the major sectors of formal employment in the area (Pollard *et al*. 1998). However, with formal sources of income becoming limited and saturated, increasing amounts of people are turning into the informal economy for income generation. Estimation from the 1995 October Household survey (Orkin, 1998) indicated that approximately 15% of the economically active population in the Northern Province work in the informal sector. They constitute 26% of all workers. Self-employed workers in the informal sector constitute 10% of the economically active population in the Northern Province, with approximately 56% of them being women.

Informal sector activities in Bushbuckridge range from food processing and beer brewing, small scale retailing of fruit and vegetables, low-cost household goods, wood carving, reed mats, other craft work, and wild herbs. Dressmaking, knitting, weaving, furniture manufacturing, car repairs and welding are also common enterprises. For most households it is not unusual to be involved in more than one of these activities at the same time in an effort to diversify sources of income. As we will see later in the research some of these activities depend on domestic water as an important input in the production process.

Overall, most household members in Bushbuckridge engage in a wide range of formal and informal activities to generate income for the household. People's livelihood system are complex, flexible and dynamic, constantly adapting and changing to both internal and external circumstances, with few households ever reliant on only one source of income (Shackleton *et al.* 1999).

1.3.6 Water resources

1.3.6.1 Availability

Bushbuckridge is located within the Sabie-Sand River Catchment, with the Sabie River as the major river and the Sand as the main tributary (see figure 1.1). The Sand River was a perennial river but stopped flowing for the first time in recorded history in 1970 (Pienaar 1985, quoted in Shackleton *et al.* 1995). Most other tributaries are seasonal rivers.

The upper catchment in the Drankensberg Mountains, with a MAP between 1500mm and 2000mm (Chunnet and Fourie, 1990) is the main water generating area in the catchment. The mean annual runoff (MAR) of the Sabie-Sand catchment was estimated to be 762 Mm^3 but this has already been reduced to 663 Mm^3 by exotic pine and gum plantations along the escarpment (ibid.). Hughes *et al.* 1996 (quoted in Pollard *et al.* 1998) provided a somewhat lower estimated MAR for the system (708 Mm^3) reduced to 498 Mm^3 due to the exotic forest in the top end of the catchment.

Insofar a groundwater is concern, Chunnet and Fourie (1990) estimated total groundwater resources of the catchment to be 30 Mm^3, although in practice only 10 Mm^3 can be used. Current utilisation is 5 Mm^3. These estimations have been superseded by a more recent and more detailed analysis of groundwater potential undertaken by VSA Geoconsultants (1998). Their estimations, based on the testing of all boreholes in the catchment, are that 7.2 Mm^3 of groundwater can be sustainably used in the catchment.

1.3.6.2 Demand and use

There is a high demand for water in the catchment epitomised in the strong competition between different users (mainly irrigated commercial agriculture, afforestation, game reserves and domestic sector), posing a serious threat to the environment and the sustainability of the resource base. In addition the Sabie River Catchment is the subject to the Best Joint Utilisation Treaty (BJUT) between South Africa and Mozambique. In virtue of this treaty Mozambique is entitle to a portion of the water resources generated in the Catchment.

Figure 1.2
Water users in the Sabie-Sand Catchment
(Chunnet and Fourie, 1990)

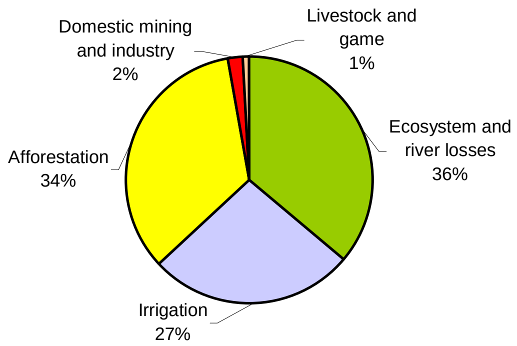


Figure 1.2 shows that afforestation and irrigated agriculture are the major water users in the Sabie-Sand Catchment, whereas domestic users account for a very small proportion of the total water use in the area.

The Sabie-Sand Catchment is also unique in comparison to other catchments in that forestry is a larger water consumer than irrigation. The reduction in streamflow caused by afforestation affects water users downstream and has led to disputes between timber growers and other farmers during past dry cycles[6].

1.3.6.3 The domestic sector

Looking at figure 1.2, it seems that meeting domestic water requirements should not be problematic in the overall scheme of things[7]. However, many household in Bushbuckridge experience severe water problems. This is due to a combination of socio-economic, historical and natural factors (source constraints), which result in poor infrastructure and management of water resources. Institutional duplication and lack of co-ordination between the different administration systems set-up during the " homeland era" resulted in inefficient domestic systems. Plans for neighbouring communities were developed independently, pipelines diverted around artificial boundaries, there was no allocation or permitting systems, and unauthorised connections at bulk and domestic level were the norm in most areas. In an example of the lack of co-ordination, the government of the former Gazankulu homeland, added and additional 20km of pipeline to a bulk water supply reticulation system in order to circumvent the boundaries of the neighbouring Lebowa (Shackletkon *et al.* 1995)

Although the situation regarding access to domestic water in the area has improved during last four years, reliable access to safe water of a sufficient quantity continues to be one of the major problems for many people living in Bushbuckridge, particularly in rural settlements. Borehole and surface water are the main sources of water for most villages in the area. However, there are spatial variations in the water service provision (regarding quality, quantity, reliability and distance to the source[8]), even at the village level.

[6] For an assessment and up-to-date figures in water use by the irrigated agriculture and forestry sectors in the Sand River Subcatchment, see Pollard et al, 1998.
[7] Calculations of domestic demand for the area are provided in AFRICON Consortium, 1998; and Conningarth Consultants, 1994.
[8] For descriptions of water infrastructure in the area see AFRICON Consortium, 1998; Pollard et al 1998; Chunnet and Fourie, 1990.

Household connection is obviously the preferred option for most people, however, this situation is seldom encountered in rural settlements, and is more frequent in fully serviced townships such as Thulamahashe, Dwarsloop, Shatale and Mhkuklu. For the rest yard connections or, more frequently, communal standpipes are the standard level of service. Table 1.3 indicates the number percentage of households in each level of domestic supply for the entire Bushbuckridge (Mhala and Mapulaneng magisterial districts.

Table 1.3
Main level of domestic supply for households in Bushbuckridge
(Data derived from the 1996 Census)

LEVEL OF DOMESTIC SUPPLY	% OF HOUSEHOLDS
Piped water in dwelling	14%
Piped water on site	16%
Public tap	50%
Water-carrier/tanker	1%
Borehole/rainwater tank/well	11%
Dam/river/stream/spring	6%
Other	2%

Half of the households in Bushbuckridge have access to public standpipes, 16% to yard taps and 14% have house to house connections. These figures include both urban and rural settlements and therefore, most of the house to house connections are likely to be in the declared townships of the area. 11% of households rely on either borehole water or rainwater tanks, while 6% use dams, rivers and streams as their main source of domestic water.

Situations where some people in the village are irrigating their lawns, while a short distance away others are queuing to fill-up buckets of water, are everyday scenes in Bushbuckridge. In some areas people still have to use water from rivers, unprotected springs, or wells dug in the riverbeds for human consumption. However, the main uses for water from these sources are personal hygiene or washing clothes, principally when fetching water involves long queues or extensive walking distances.

Recycling of water, known as “grey water”, is a very common practice, and is used mainly to water fruit trees, small lawns or flower beds around the household. Vegetable gardens only occur where there is a reliable water source available. Such winter gardens are mainly seen in households with yard connections, with gardens being watered using hose pipes or sprinkler irrigation. However, vegetable gardens are also evident in areas with easy access to rivers, springs or cattle dams, and in this case, irrigation is done using buckets.

Water obtained from the existing (ex-homeland) reticulated and borehole schemes is generally not paid for. As we will see in chapter 6, there are very few functioning formal institutional arrangements regarding payments for water. However, this needs to be qualified to some extent since water is frequently paid for on an informal basis and is a very expensive commodity for many households. Water vending is a common business, and people owning private transport often hire their vehicle to fetch water in neighbouring villages (or sections) when the water runs out, when there are functions in the village (funerals, weddings), or for regular activities such as beer-brewing or brick-making for building. In some villages, people buy from vendors on a daily basis, even for basic consumption, and there are also cases where the only yielding borehole in the village is privately owned, forcing villagers to purchase water from the borehole owner.

1.4 STRUCTURE OF THE REPORT

The report is structure in the following chapters:

Chapter 2 presents the general methodological approach for the research and highlights the main methodological lessons learnt from the experience. Details on specific methods follow in the calculation of some of the figures presented in the rest of the chapters are provided in the relevant sections.

Chapter 3 presents and discusses figures on water consumption for “basic needs” in each of the villages (see definitions in next section)

Chapter 4 deals with water consumption for water related “low level economic activities”

Chapter 5 discusses the economic returns for the water used for economic activities and highlights the importance of those activities in the context of rural livelihoods in the area

Chapter 6 presents evidence on payment patterns in the area and discusses issues of around willingness to pay for water in Bushbuckridge

Chapter 7 summarises the main conclusions and policy issues arising from the research.

1.5 DEFINITION OF TERMS

This section lists the important terms which occur in the report and provides the definition adopted for the purpose of this report.

Communal standpipe: Tap located within the village. In villages where RDP minimum levels are met, communal standpipes are located to a maximum of 200 metres from each household.

Community gardens: Type of garden that a communal area within the village or in the vicinity. The land is communally use and various individuals from the village have access to one or more plots in the garden. The water source normally consists of a borehole equipped with a pump, or water pumped from cattle dams, rivers or streams. In some instances irrigation is done by bucket from adjacent sources. We did not look at water consumption for these gardens as they fall out of the definition of domestic water.

Community section: Part of a village or community[9]. Normally the section has a name that in many cases is the name of the community followed by a letter (for example Violetbank F). In large communities it is usual for each section to have its own structures in the form of civic associations and/or committees dealing with specific problems of the section. In these case each section function as if they were a community on their own. However the most common case is that there is some kind of coordination between the structures of the different sections and community meetings are called for all the sections at once.

Domestic water: It refers to the water available to the household members for use in the homestead area or household compound. This water is normally available from reticulated supply systems (in yard or communal), carried home by household members and or bought from water vendors. Domestic water is typically used for life supporting activities (drinking, cooking, personal hygiene, household cleaning and washing clothes), and for economic activities occurring in the homestead area (gardening, fruit trees, building, beer brewing, homestead based businesses).

House to house connections: Water piped to individual households having full reticulation. Water is therefore available in the kitchen, bathroom and toilet. Taps are also available in the garden for watering and maintaining the garden.

[9] Note that the terms village and community are used interchangeably throughout the report.

Gross margins: Value of the good and/or service produced minus the operating costs for the activity.

Homesteads (stands/households compounds): Refer to the physical the plot of land that typically includes the living unit (one or various rooms interconnected or located in several individual structures) and a variable amount of land around it. The plots are normally fenced and vary in size and shape depending on the location. In most villages the stands haven orderly set out in a rectangular grid. Stand sizes varies from place to place (from 1500 m^2 to 3500m^2)

Household: A household consist of a single person or a group of people who live together for at least four nights a week, who eat from the same plot and who share resources.

Vegetable garden/private garden: Type of garden that occurs within the homestead area or plot. They are run by individual households and domestic water is used for their irrigation (as per the definition above).

Water demand: Refers to the quantity and quality of water community members will choose to consume at a given price.

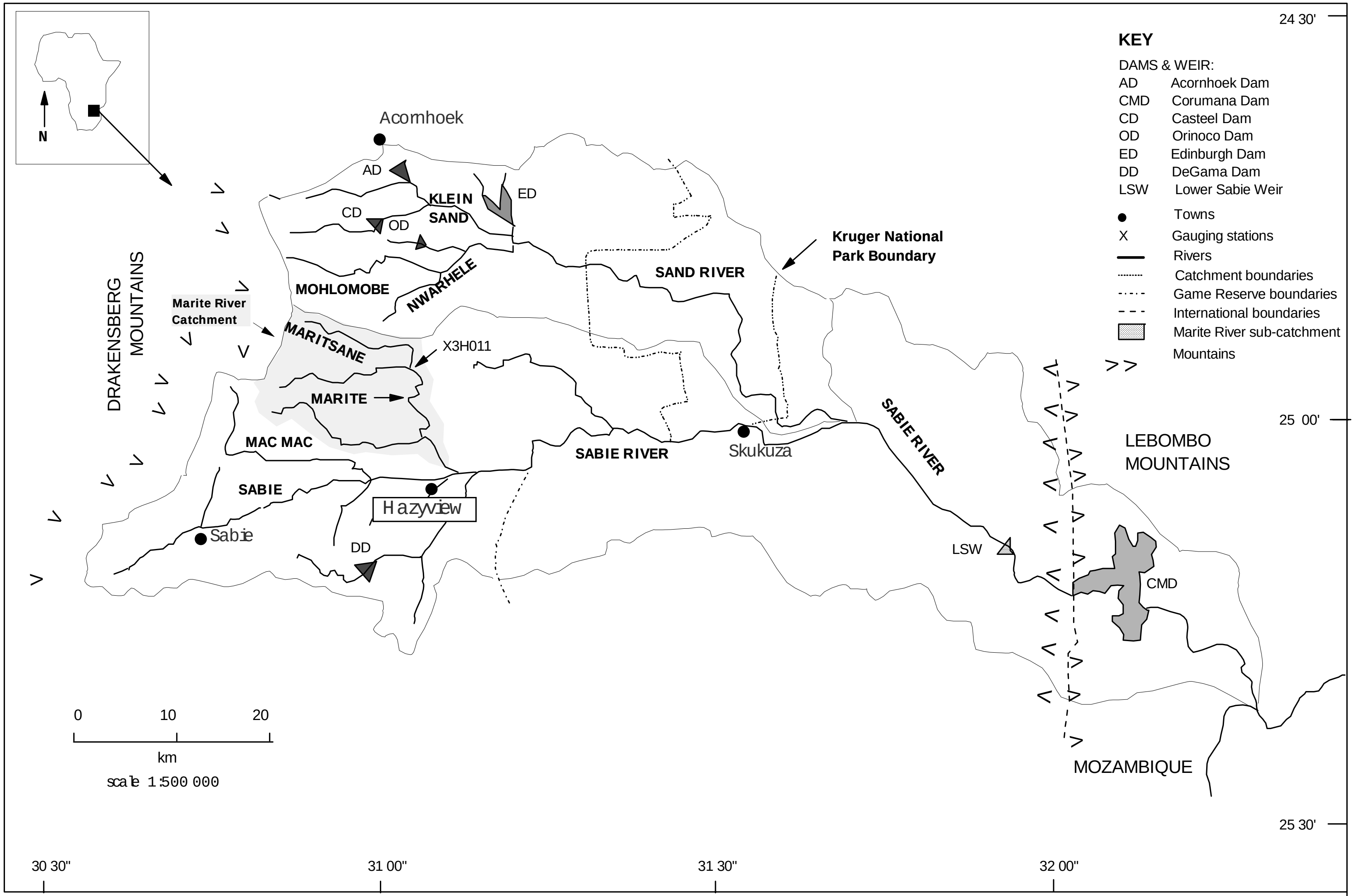
Water dependent "low level economic activities": This term refers to the productive uses of domestic water. Water dependent "low level economic activities" are small business undertaken by individuals using domestic water available to them. Examples of these activities are vegetable gardens, fruit trees, livestock rearing, traditional beer brewing, building activities, ice-block making.

Water for basic needs: Refers to the amount of water used for human consumption (drinking, food processing), household cleaning, personal hygiene and washing clothes.

Yard tap: Tap located within one individual stand.

Figure 1.1
The Sabie Sand River Catchment

15



CHAPTER 2
OVERALL RESEARCH METHODOLOGY

2.1 INTRODUCTION

The research was part of a learning process both for AWARD and for the communities involved. It looked into issues that historically have received very little attention in South Africa and for which data is also very scarce in other African countries. In a recent study that reviewed existing empirical evidence on household water resources and rural productivity in Sub-Saharan Africa it was recognised that, despite the quantity of studies carried out, relatively little is known about water use in rural areas. They indicate that “…*most research has focused on the developing world’s rapidly expanding cities. Among the regions of the world, research gaps are most acute for sub-Saharan Africa….”* (Rosen and Vincent, 1999).

This chapter explains in detail the research process and the approach taken in the study. It also analyses some of the lessons learnt from experience and shares some of the concerns arising from the “researcher’s” relationship with rural communities in a research environment.

2.2 GENERAL METHODOLOGICAL APPROACH

2.2.1 Data sources

Data for the research was obtained from a combination of primary and secondary sources:

1. Primary data: Most data for the research was obtained through intensive fieldwork using participatory methodology. The approach and data collection methods are described in this chapter

2. Secondary data: Three main sources of secondary data were used. All the sources used are quoted in the relevant chapters and full references are provided at the back of this report.
   - Previous studies dealing with different aspects of the Bushbuckridge area. Reports on the water resources, general livelihoods systems, the value of livestock and gardening activities provided useful information for the research.
   - Available literature on domestic water consumption from other parts of South Africa and also from other countries in Southern Africa were also used to compare to our fieldwork results
   - 1996 Census data for the entire Northern Province and also at district and enumerator level.

2.2.2 Selection of villages: Case studies

A comparative village-case-study approach was used in order to meet the objectives of the research. In order to select communities for inclusion within the study, the following issues were considered:

- Bushbuckridge is currently divided into three administrative areas - north, midland and south, each of them having an independent local council and different institutional arrangement regarding domestic water provision.
- Under the former homeland system, the area was divided between two different homelands. Gazankulu comprised most of the eastern portion of present Bushbuckridge and Lebowa the western part. Each homeland government had its own policies and institutional arrangement regarding domestic water supply and current situation reflects to a large extent the legacy of the former system.
- From a climatic point of view, there is a distinct "west-east" division between those villages close to the mountain with relatively high rainfall and those to the east in the more arid zone. Differences in rainfall are likely to have an impact in the level of access to water in a particular village, and therefore affect consumption patterns

As these institutional and climatic differences are likely to have an effect on the domestic water supply situation of a given village, Bushbuckridge was subdivided into 6 areas: north-west, north-east, midwest, middleast, south-west, south-east (see figure 2.2). This was then followed by a baseline study that covered the six areas. It consisted of a rapid assessment of 27 communities in order to gather general socio-economic data and information on: • village water supply and its reliability, •water infrastructure, • activities in the village using water, • the institutional set up of the village, • willingness to take part in the research and also • some logistics for fieldwork (when do the structures and people meet? Is there a place to stay?). Villager's perceptions about the domestic supply in the village were also gathered and they complemented visual checks of available water infrastructure.

Within each area two villages of similar socieconomic and physical attributes but **diametrically opposed domestic water supply situations** were chosen. The criteria for selection are shown in table 2.1. For the purpose of this study the villages were termed as "worst case" and "best case" scenario

Table 2.1
Research categories and main characteristic for each category

CATEGORY	CHARACTERISTICS
"Best case scenario" villages/sections	• Functional reticulated supply. Minimum RDP standards met for all households • Most households have one or more yard taps • Very few households have in-house connections. • Water supply is very reliable • Yard tap is the highest level of service
"Worst case scenario" villages/sections	• No reticulated supply in the village (or non-functional). • Minimum RDP standards are not met for all households • Large differences in the level of service between households • People walk long distances and queue to fetch water • Supply is very unreliable and people face long periods without water. • Most households suffer severe shortages of water. • Private vendors are common • Community tensions arise due to differences in access to water

Using the above criteria the following "best case" and "worst case" villages, shown in table 2.2 were selected in each area.

Table 2.2
Case study villages[1]

		CLIMATIC DIVISION	
		West	**East**
ADMINISTRATIVE AREAS	**North**	*Dingleydale "B"* ↔ Township Tsakane	*Utha* ↔ Dixie
	Midlands	*Shortline* ↔ Violetbank F	*Xanthia* ↔ MP Stream 'C'
	South	*B&M* ↔ I tereleng	*Kildare B* ↔ Mabharule

In general levels of water service provision varied within villages and therefore, isolated sections were selected to represent either "best case" or "worst case" scenarios. Intra-village comparisons were not carried out because the research process could have created conflict in the community through highlighting differences in service provision. In cases where community conflict could be triggered, extensive discussions took place with relevant structures (water committees, Reconstruction and Development Committee members, Induna) in order to assess the situation

[1] Shortline is a section of a larger community known as Arthurseat. In the cases of Dingleydale 'B', Xanthia 'A', MP Stream 'C', Kildare 'A' and Violetbank 'F' the letters refer to the name of the specific section of a larger community of the same name. Violetbank 'F' is also known as Chris Hani. Township is a section of a larger community known as Rooiboklaagte. Tsakane is a section of Mamelodi. Matafeni, Boshoek and Itereleng are three sections of a larger community know as Goromane.

and decide whether to go ahead with the process or not. . It has been documented that some communities prefer not to engage, or even to abandon certain development in the village if it poses a threat to community harmony. In a study looking into the reasons for community non-compliance with basic water supply projects, Lynette Dreyer observed that *"…communities preferred to abandon water projects that had become a source of conflict in their village even if it meant carrying water long distances in searing summer heat."* (Dreyer, 1998).

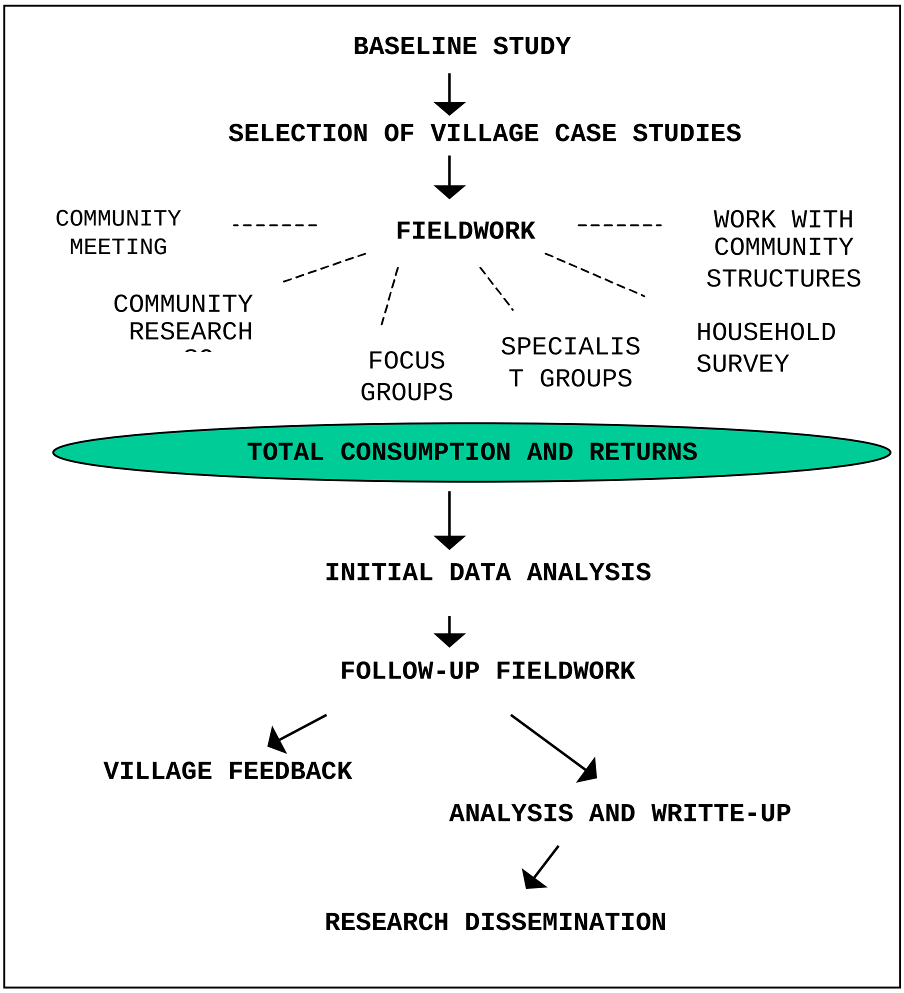
2.2.3 Limitations to the case study approach

Although selection of case study communities tried to control for factors other than the differences in access to domestic water supply, this was not always possible. Some of the differences in the analysis presented in the research are conditioned by factors other than access to domestic water supply. Whenever possible these factors were identified and their importance assessed by using qualitative data and/or anecdotal evidence.

2.3 RESEARCH AT VILLAGE LEVEL

Six to seven days were spent in each of the villages over the study period. Emphasis was place on allowing the community members enough time to discuss research issues. Figure 2.1 provides an overview of the process followed at village level

Figure 2.1
Overview of the research process



2.3.1 Initial contact with village structures

In each village a combination of traditional authorities and elected local government structures coexist. On top of those there are also a plethora of committees and social and political groupings (churches, branches of political parties, burial societies, women groups, etc.). In many cases it is unclear who is responsible for what in the village and conflict about competence over issues is common. Hence it was deemed very important to keep everybody informed and to have them agreeing about the structure that should lead the research process in the village.

After assessing the institutional structure of the village, the relevant structure was either called to an ad-hoc meeting, or else, the research team was invited to one of their regular meetings. The AWARD team explained the purpose of the research, its intended use, what could be expected from it and what not, and the level of information required. After clarifying doubts and answering questions the following was requested from that structure:

- Call a community meeting to explain the research to the rest of the community
- Help with the logistic of the research (accommodation, venues, meetings)
- Suggest key people and/or structures that should be approached and/or interviewed
- Select a group of people who would be the research link for the village. These people would work together with the AWARD team and prepare the strategy for the research activities. They would also take part in the fieldwork and in the process of analysis of the data generated in the village.

2.3.2 Community meetings

The objectives of mass meetings were:

- To introduce AWARD to the community, and to explain the importance of the research and why they should participate
- To clarify objectives and outputs and deal with the expectations at an early stage in the process
- To obtain their agreement and permission to go ahead with the research
- To gather initial information
- To gain a general understanding of water use in the village
- To gather specific information from a large sample and to gather specific information
- To arrange further work with individuals and small groups

Information gathering in the mass meetings was the cornerstone of the methodology as it was initially designed. People generated a detailed list with all the activities that required the use of domestic water. Researchers from AWARD facilitated discussions about the nature of each activity, the quantity and quality of water required and its source. Particular emphasis was placed on the identification of economic activities that required the use of water.

2.3.3 Preliminary analysis and follow-up data collection

Data gathered during the initial fieldwork was consolidated and initial consumption figures per activity per household were produced for each village. This preliminary analysis for each case study pointed to inconsistencies and problem areas that needed further research. In these cases we conducted follow-up sessions consisting of discussions with key individuals, specialist group discussions, triangulation of problematic information, and further data collection.

2.3.4 Feed-back report

A village feedback report was prepared for each of the case study villages. The main findings of the research in the village were presented in a meeting attended by the community structures that had acted as research liaison, and also by interested villagers. Figures and their meaning were presented using pictures and examples, and the conclusions from the research were scrutinised and discussed by the participants.

The village report contained the main figures for the village, the method used to collect and analyse them and the main conclusions. The report was provided both in English and in a local language and handed to the local authority to be kept in the village. Additionally, the possible uses for the report were looked at in detail and a way forward agreed for any intervention requiring support from AWARD. Communities identified feedback as being very important and being lacking in previous interventions.

2.4 METHODS FOR DATA GATHERING

Information gathered during mass meetings was followed-up at three different levels:

- Group discussions (specialist and non-specialist groups)
- Household interviews (semi-structured)
- In-depth interviews with individuals

2.4.1 Group discussions

The number, dynamics and specific method used varied from case to case. Most of them were informal discussion with a list of topics that the facilitator would introduce as the conversation developed. Apart from the initial mass meetings, group discussions tended to be small (4 to 10 people). Although some of the groups were organised in advance (water committees or women's groups included), many of them also evolved from discussions with individuals that insisted in having their peers. The issues discussed in each group depended on whether it was a specialist group or not.

2.4.1.1 Non-specialist groups

These were attended by individuals who did not share any characteristic or variable of interest to the research other than living in the same community and/or household. They usually happened after community meetings or spontaneously during the research process. Discussion centred on general issues regarding water infrastructure, access to water, institutional arrangements, etc. Non specialist groups also gathered around mapping exercises and helped with transects to validate sampling frames. These groups were very useful in completing the list of water dependent activities in the village, in identifying key informants and people having business using water, and in cross-checking and triangulating the information gathered in the community meetings.

4.4.1.2 Specialist groups

People sharing a particular characteristic, interest, or activity relevant to the research. Amongst these groups, we normally held discussions with beer brewers, garden associations, builders, cattle herders, and also with community structures. Meetings centred on specific issues regarding their activities, the way they were organised, patterns of water use in their specific business, etc.

Information provided by these groups was very relevant in the preparation for the in-depth interviews with specialist users of water. As an example, traditional beer brewers were always an important group to bring together.

2.4.2 Semi-structured household interviews

In the first three case study villages (Utha, Dixie, and Mabharule), household interviews were used to complement and validate the information gathered in the mass meeting and group discussions. The number of interviews varied from village to village, and depended on the amount and quality of information generated in community meetings and group discussions. The section of households was not randomised. The selection of the first household was an arbitrary choice and thereafter, every third household in the same street was interviewed. This method worked well in communities that knew and trusted AWARD.

In communities where AWARD was not well know, mass meeting were not successful and therefore data was gathered through specialist group discussions and semi-structured interviews to a random sample of households. This highlights the importance of building up relationships prior to research.

Sampling frames were constructed for each village. Existing village maps were ground- tested, modified and used when possible. ESKOM maps were used in one of the communities in which all households were electrified. Maps from the Agincourt Demographic and Health Information Project (CCP)[2] were also used in communities in the Agincourt area. Participatory mapping exercises were carried out in villages in which maps were not available or were very inaccurate. In most villages mapping was a very successful activity and contributed to a better understanding of the research for the participants.

2.4.3 In-depth interviews with key informants

In-depth interviews generally centred on specific issues and allowed higher quality data to be obtained. For example, in-depth interviews with brick makers assisted in the development of a simple way of estimating the amount of water used for building (chapter 4).

Economic data was also gathered during the interviews. Discussions centred on the benefits obtained from the activity, the character of the production (whether it was mainly for self-consumption or for sale), the expenses it generated, the main inputs required, and the commercialisation channels. The importance of the availability of water for the activity was also discussed in each case.

2.5 OVERALL APPROACH TO DATA ANALYSIS

2.5.1 Unit of analysis for the research

Three units of analysis are used in the study: the *village (or community)*, the *household* and the *individual*.

The use of ***village/community*** as the primary unit of analysis reflects methodological, social and institutional reasons. Community involvement has become the paradigm in rural development interventions. Decisions regarding the design, level of provision, management, payments, and operation and maintenance of community water systems are normally taken at community level.

The research methodology, (PLA - Participatory Learning and Action) was linked to the specific aim of improving the level of information around the economic uses for water within communities. Information gathered demonstrated the economic use of water and could be used for lobbying and also to develop more appropriate long term solutions to financial sustainability and cost recovery for their systems. Furthermore, the characteristics of the information to be gathered in the research required a strong buy-in from the community. It required asking about economic

[2] The Agincourt Demographic and Health Information Project (CCP Project) is co-ordinated from the Health Systems Development Unit (HSDU) based at the Tintswalo Hospital, Acornhoek. The have produce a Population Fact Sheet for each of the villages in which they work. Each fact sheet contains a computerised version of a village a map produced by fieldworkers and villagers in each of their project villages.

gains from business that in many cases are not registered, or simply from activities that are not socially acceptable to some groups and individuals, for example, beer brewing and selling.

The ***household*** was the unit of analysis for certain aspects of the research as it was easier for most people to discuss water collection and consumption patterns with reference to the household.

Finally, the ***individual level*** was used to present and compare figures for different villages. Figures presented as averages per capita per day allow for easy comparison between villages with different average household numbers and are also used in most studies presenting empirical evidence on domestic water consumption. It provides a good benchmark against which national and international minimum standards for water provision can be measured (for example the South African minimum RDP level of supply).

However caution is required when translating household consumption into average per capita consumption. The underlying assumption is that all individuals within a household irrespective of their age and gender have equal access to equal amounts of domestic water, to the health and economic benefits it can generate and equal right to prioritise its use. Household dynamics in Bushbuckridge are complex to a combination of related to kinship relations (extended families), the existence of polygamy, and the high prevalence of migrant workers. Age and gender differences in the access to resources are very acute and decisions over the allocation of resources happen in the context of the different set of objectives that exist for individuals within the household (as opposed to a unique set of objectives for the household).

2.5.2 Analysis of fieldwork results

Consumption for “basic needs”, economic activities and the gross margins generated were analysed separately. Average figures per activity were calculated for each of the villages and for the combined categories of villages (“best case villages and “worst case villages”). The percentage of households involved in at particular activity per village was estimated in order to assess its importance, and the differences between “bests” and “worst cases”. Water consumption patterns and gross margins generated were then analysed at two levels:

- Average figures per capita were calculated for those households engaged in each activity. This gave an indication of the amount of water used for the activity and the average returns.

- Average figures were then calculated for all individuals and households in the village, regardless of whether they were involved in the activity or not. These figures were used to aggregate consumption and gross margins across all activities in order to build an average profile for an individual in each community. This profile would indicate the total consumption per capita per day and the total gross margins per capita per year. These average profiles were then used to compare the situations in “best case” versus “bad cases” villages.

Statistical tests were conducted to determine whether the differences between “best case and “worst case” were significant.

2.6 METHODOLOGICAL LESSONS LEARNT FROM THE RESEARCH

2.6.1 Community expectations

AWARD is known in the area as establishing community based water supply systems and therefore raised expectations, particularly in communities with severe water shortages. Facilitators and researchers made a conscious effort not to raise expectations. From the outset it was stressed that that the research would not bring immediate benefits to the village or solve their water problem .

2.6.2 Incentives to give the "wrong" information

Water is a very sensitive issue in Bushbuckridge. Power and conflict over control of scarce water resources is present within and amongst communities. Given these complexities, people may have incentives to avoid participating and/or to give the wrong information and this can affect the methodology and it can also have implications for research resources (time, money, training…). This problem was identified by both facilitators and community members as an important constraint to the results obtained.

For example, in villages with unequal access to water between sections, and also in villages with relatively good supply of water, the incentive was to underestimate the amount of water used. Community members expressed the fear that the research was an attempt to introduce water meters, charge high prices, and to collect taxes from the businesses. On the contrary, in villages with chronic shortage of water expectations of an immediate project meant that there was a tendency to overestimate the amount of water needed for each activity and to magnify the problems related to the lack of access to water.

The cases of Xanthia and Dingleydale illustrate the previous points:

- Xanthia is a case of a community with unequal access to water within the community. One section gets most of the water while the other has supply problems. Respondents in the best-supplied section tended to be defensive and quote low figures for water use.

- Preliminary results indicated that Dingleydale, a village with a fairly good water supply, had a lower per capita consumption than neighbouring villages where there was a lower level of service Villagers had mistakenly linked the project to the introduction of water meters and therefore underestimated their consumption. For these reason information had to be continuously crosschecked and validated. This highlights the need to allocate enough time for this purpose

2.6.3 Participatory processes can be perceived as a threat

Participatory research can also create conflict in a community that is not used to consultation. Because of recent history and past experiences linked to apartheid, people in BBR are not used to participatory interaction with outsiders. Participatory styles of work and local decision making can raise suspicion about the "real motives" of the outsiders, particularly when people are not used to being informed of decisions affecting their lives. Community consultation and participation is sometimes a foreign concept to communities that have never been consulted. In some areas people expressed their fear to give their opinions, their views and personal information.

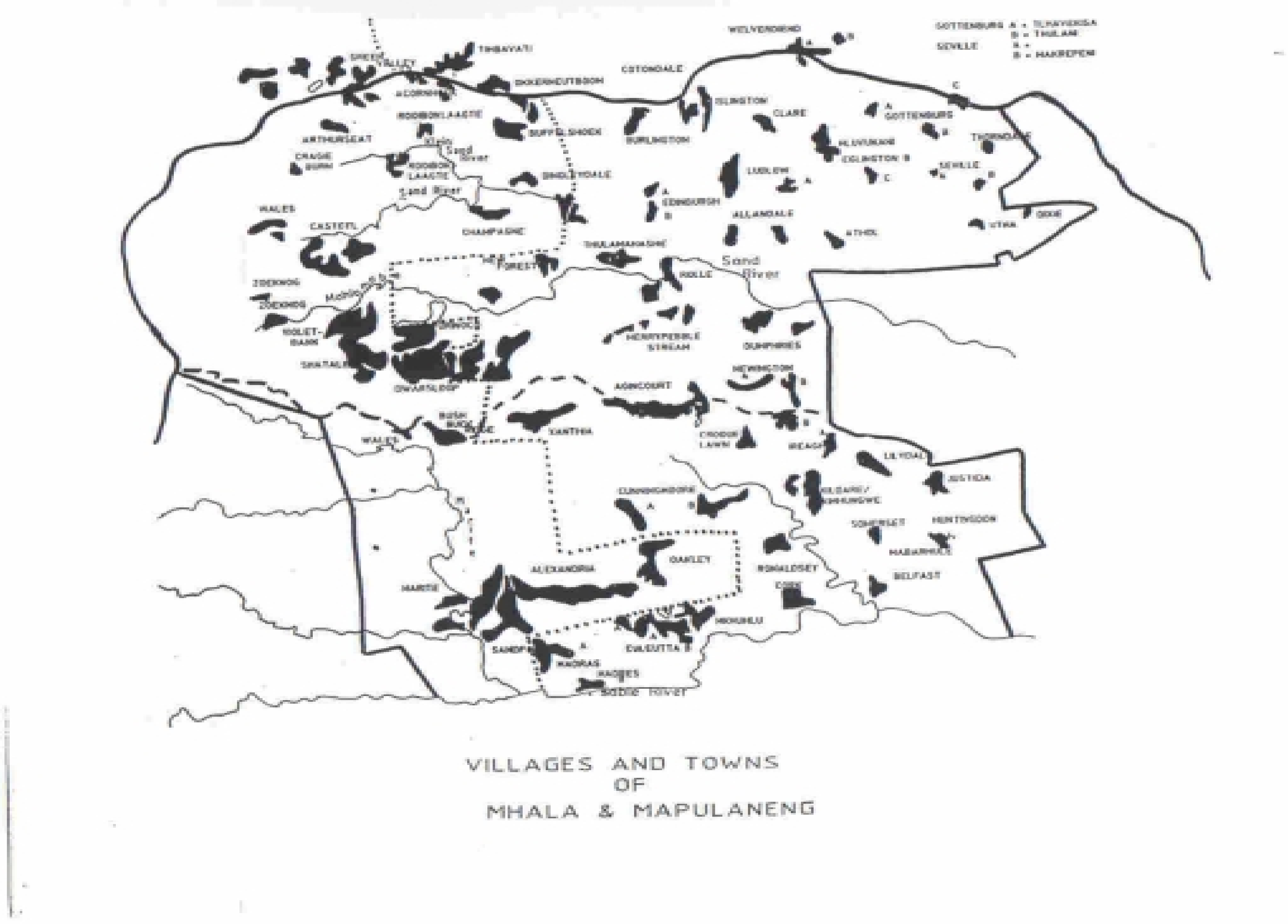


Figure 2.2 The Bushbuckridge area. Villages and their locations

CHAPTER 3
DOMESTIC USE OF WATER FOR BASIC NEEDS

3.1 GENERAL INFORMATION FOR OUR CASE STUDY VILLAGES

3.1.1 Population statistics

Table 3.1 summarises the main population statistics for each village. These figures were used to calculate average per capita/day consumption figures for all the uses of domestic water.

Table 3.1
Population statistics in case study villages

“Best case scenario” villages				***“Worst case scenario” villages***			
Village	**Total Population**	**N.of hh.**	**Ave hh. Size**	**Ave hh. size**	**N. of hh**	**Total Population**	**Village**
Shortline	165	35	4.7	4.9	360	1800	Violetbank F
Dingleydale	1759	268	5.5	5.6	314	1765	Township
Boshoek &Matafeni	1225	175	7.1	5.9	20	119	Itereleng
Utha	1250	221	9.8	5.2	76	430	Dixie
Xanthia A	1023	165	6.3	7.5	207	1594	MP Stream C
Kildare B	1729	290	6	7.4	378	2007	Mabharule
				5.8	29	165	Tsakane
Class Average			***6.2***	***6.1***	**Class Average**		

3.1.2 Main sources of water

A general description of the situation regarding main sources of domestic water for the Bushbuckridge District is provided in chapter 1 (section 1.3.6). Villages follow the general patterns for the region and therefore, borehole water and surface supply are the primary sources of water for basic needs in most villages. However, in four villages within the "worst case scenario" category (MP Stream C, Violetbank F, Township and Mabharule) reported the use of hand dug wells in annual streams running through the village. Extensive use of rivers and streams for basic needs activities (mainly personal hygiene and washing clothes) was also reported in the 5 case study villages with access to rivers and streams. Table 3.2 summarises the main water sources available to each village as reported during fieldwork.

Table 3.2
Reported available water sources per village
BC= "Best case scenario", WC= "Worst case scenario"

Village	Category	Main sources of water
Shortline	BC	• Borehole water • Diesel pump to plastic tanks (jojo)
Dingleydale B	BC	• Mutlumuvi river. Chemical treatment. • Electric pump to concrete tank • Mutlumuvi River
B & M	BC	• Bulk supply (Hoxani treatment plant) • Boosting station to a concrete reservoir • Sabie River
Utha	BC	• Borehole • Diesel pump to yoyo tank • Cattle dams
Xanthia A	BC	• Bulk supply (Tulamahashe) • Boosting station to concrete reservoir • Cattle
Kildare B	BC	• Bulk supply and borehole • Electric boosting into some hh. • Diesel pump to jojo tank • Hlabambaneni river
Dixie	WC	• Borehole • Diesel pump to jojo tank • Cattle dam
Tsakane	WC	• Reservoir in Maripe School in a neighboring section • Motlasedi River
Itereleng	WC	• Neighbours in B&M • Sabie River
MP Stream C	WC	• Borehole with handpump • Hand dug wells in annual stream • Cattle dam
Violetbank F	WC	• Borehole with handpump • Hand dug wells in annual stream
Township	WC	• Reservoir in Lekete School • Privately owned borehole • Hand dug wells in the Mutlumuvi River • Mtlumuvi river
Mabharule	WC	• Bulk Supply (Hoxani) • 3 home made connections to unreliable pipe • Hand dug wells in annual streams

3.2 WATER CONSUMPTION FOR BASIC NEEDS

3.2.1 Definition of terms

For the purpose of this research, the term “Basic Needs” refers to the amount of water used for drinking, food processing, household cleaning and personal hygiene (henceforth referred to as HC) and also the water used for washing cloths (henceforth referred to as W) (see definitions in chapter 1, section 1.5)

Under the Water Act (Act 36 of 1998), universal access to a minimum amount of water for basic human needs (at least 25 litres of water per person per day) is created through the establishment of the domestic or human reserve (discussed in Chapter 1 Section 1.1.2.1 of this report). The working definition for basic needs has been adopted in order to compare real consumption figures from our case study villages with the provisions of the new law, using 25 litres per person per day as the benchmark for comparison.

3.2.2 Estimation of “basic need” consumption

In households where water was obtained from public/communal sources, daily amounts fetched and used were estimated using the 20 to 25 litre containers (Sturuturu) used by most people, as the reference measurement. As general approach for the calculations, whenever a range was given as an answer, the mid-point of the range was noted and used for the calculations.

Problems arose when interviewing people who had a yard connection and therefore did not have to carry water. Here households were unable to estimate the amounts used. However, in most households with yard connections, women still stored water for daily consumption and were able to determine the capacity and frequency of refills.

Water used for washing was separately accounted for. Most households wash clothes once or twice a week. Water for this activity is fetched separately. Consumption was estimated through the determination of the number of tin baths (50 to 100 litres) used per day.

3.3. FIELDWORK RESULTS

3.3.1 Consumption figures for basic needs

The mean daily per capita consumption for Basic Needs for each case study village is presented in table 3.3. Mean daily consumption figures for HC and W are provided separately and then combined into a total consumption figure for Basic Needs (litres/capita/day). Each village is presented alongside its “worst” or “best case scenario” (see table 2.2). Furthermore, class averages are also calculated for the “best case scenario” and “worst case scenario” villages as a group (see table 2.1). Appendix 3.1 summarises the main statistics per variable per village and provides an indication of the level of variability of the data around the calculated means.

The figures in table 3.3 show that, on average, basic water needs are met within the first 25 litres per capita per day (RDP minimum recommended quantity) in all twelve villages. Class averages for the two categories of villages show that, on average, water consumption is 1.2 litres higher in villages with better water supply (22.4 compared to 21.2). Consumption for drinking, cooking, personal hygiene and household cleaning accounts for most of the difference (17.6 compared to 16.8), whereas the amount of water used in washing clothes is only marginally larger in villages with better supply.

Table 3.3
Average daily per capita water consumption for Basic Needs (HC + W)[1]
(litres/capita/day)

"Best case scenario" villages				**"Worst case scenario" villages**			
Village	**HC**	**W**	**TOTAL[2]**	**TOTAL[2]**	**W**	**HC**	**Village**
Shortline	19.2	4.4	**22.8**	***22***	-	-	Violetbank F
Dinglydale	18.2	4.7	***22.4***	***20.9***	5.4	16.4	Township
Boshoek &Matafeni	15.1	5.3	***20.4***	***22.8***	5.1	18.2	Itereleng
Utha	20.8	6.8	***27.1***	***23.7***	5.2	19	Dixie
Xanthia A	15.6	5	***21***	***18.8***	-	-	MP Stream C
Kildare B	16.5	4.3	***20.6***	***21***	3.3	16.4	Mabharule
				19.3	5	14.1	Tsakane
Class Average	*17.6 (m_{11})*	*5.1 (m_{12})*	**22.4 (m_1)**	**21.2 (m_2)**	*4.8 (m_{21})*	*16.8 (m_{22})*	**Class Average**

HC: Water for human consumption, personal hygiene and household cleaning (including dishwashing)
W: Water used for washing clothes

However, a more detailed analysis of the results presented in table 3.3 shows that:

- Per capita daily water consumption for drinking, cooking, personal hygiene and household cleaning (HC) is higher in the "worst case" village in at least one pair of villages (B&M - Itereleng). Also both Itereleng and Dixie show higher HC consumption than four of the "best case" villages (Dingleydale, B&M, Xanthia and Kildare), and higher mean HC (18.2 and 19) than the "best case scenario" class mean (m_{11}=17.6).

- The class average for HC in the "best case scenario" villages (m_{11}) is highly influenced by the average in Utha (20.8). However, Utha's mean HC is obtained from a very limited number of observations (4) and therefore the estimate may be biased (see appendix 3.1). When Utha is excluded from the calculations the class average drops to 16.9, which is nearly the same as the HC mean for the "worst case scenario" group (m_{22} = 16.8).

- Differences in the mean water use for washing clothes in both groups are very small. There is one pair of villages (Dingleydale - Township) in which the mean consumption is higher in the "worst case" village (4.7 and 5.4 respectively). Three of the "worst case" villages (Township, Itereleng and Dixie) present a higher mean W than three of the "best case" villages, and in all three the mean W is equal or higher than the combined "best case scenario" class mean (m_{12}=5.1)

Therefore, although class means seem to indicate that basic consumption of water is somewhat higher in villages with better water supply, these differences may be due to the variability of consumption between households in the each of the villages, and not to the difference in supply between "best" and "worst" case scenario villages.

---

[1] All figures rounded to the nearest half litre
[2] Figures under the variable total consumption are not the direct addition of the figures under HC and W. Estimations for total consumption were obtained by adding the consumption for HC and W in each household. However, not all households were able to estimate HC and W separately.

In order to test whether the differences in mean consumption shown in table 3.3 were statistically significant, two sample t-tests were conducted for the difference of means between "best" and "worst case scenario" village for the three variables (HC, W and Total)[3]. All three variables were tested for normality. None of them were normally distributed and the data was therefore transformed through a natural log function in order to be able to proceed with the test. Table 3.4 summarises results of the t-tests.

Table 3.4
Results of the two sample t-test for the differences between class means of "best" and "worst case scenario" villages.

Variable	**Ho**	**df (n_1+n_2-2)**	**Computed t statistic**	**p**	**Decision at ∀=0.05**
HC	$m_{11} - m_{22} = 0$	220	0.36	0.71	Do not reject Ho
W	$m_{12} - m_{21} = 0$	203	-0.82	0.41	Do not reject Ho
Total	$m_1 - m_2 = 0$	272	0.76	0.44	Do not reject Ho

All three tests indicate that, at 95% confidence, the null hypothesis (no difference between the sample means of "best" and "worst case scenario" villages for the three variables "HC","W" and "Total") could not be rejected with the existing data. Therefore, the differences between the means cannot be attributed to the different water supply situation between the two groups of villages. In other words, **with the available data it cannot be concluded that consumption for basic needs is generally higher in villages with better access to water supply.**

The highest average level of service in the study villages was yard connections, and only very few people had in-house connections. This has two important implications that account for the lack of significant differences in consumption between "worst" and "best case" scenario villages

- The consumption of water for drinking, cooking and household cleaning is unlikely to increase a lot with increased availability of domestic water. In a "before/after" case study carried out in Utha after their domestic supply was improved to RDP minimum levels, households indicated that the quantity collected for their daily used had not increased (see appendix 3.2). In villages where most households have access to functioning yard taps, it was observed that women still found it more convenient to store water for daily use in the kitchen or within the household (people indicated that the yard tap was not always located in convenient places). Therefore, when water must be carried, daily water use is likely to be the minimum necessary for household purposes and tends to be used conservatively. Significant differences in consumption (at least for drinking, cooking and household cleaning) are not expected to be found unless the household has access to kitchen connections. Evidence from research elsewhere in Africa also shows that if water must be carried, the quantity brought home varies little for sources between 30 meters and 100 meters from the household (White, Bradley, and White, 1972).

- Water-borne sewerage systems were absent in all the villages in our sample. None of he interviewed household had access to a washing machine and only a few had showerheads available to them (in some villages such as Kildare 'B', Xanthia 'A' and Matafeni & Boshoek people had showerheads consisting of a room with a hosepipe connected to a yard tap). In the few households (4 households in entire sample) that had kitchen connections and/or showerheads, people reported a higher usage of water for basic human consumption than their neighbours did. Consumption figures for these households were difficult to obtain due to the absence of proper metering systems. Approximate measurements were attempted by measuring the flow of the tap and the amount of time used in each activity. Data obtained

[3] Assume independent samples.

from these interviews were recorded for comparison purposes but treated as outliers in the statistic analysis. The lowest measured consumption for HC in a household with showerhead was 75 litres per person per day (the measurement was taken in M&B and the household owner indicated that the water pressure in the tap was lower than normal). The highest recorded HC consumption in household with a showerhead was in Dingleydale (100 litres per person day).

3.3.2 Time spent collecting water

Long queues around water points were observed during the time of fieldwork in most villages classified as “worst case scenario”. Although data on the average queuing time was not collected, in some areas people reported waiting from half an hour to a maximum of 6 hours to fill one sturuturu (25 litres of water). In MP Stream, one source was seen where women were waiting 10 minutes for a litre of water. The fourth woman in the queue was collecting water at around mid-day having waited since early in the morning. In Utha, following the upgrading of the domestic supply system to RDP minimum standards, people indicated that as a result of the project the stress of water collection has decreased significantly due to reduced distances and lack of queuing. Prior to the improved system, people used to spend many hours queuing for water (see appendix 3.2)

3.3.3 Limitations

The consumption figures presented in this chapter can be regarded as conservative estimates of actual consumption. The absence of water metering devices in the sample villages resulted in some consumption being unaccounted for, particularly when the consumption happened out the household context:

- Women in some communities indicated that some members of the households (mainly male and children) would use extra water for personal hygiene that was not accounted for in their calculations. Whereas female members of the household would wash themselves at home to preserve their privacy, male and children would often go to rivers, springs and/or communal taps for personal hygiene. In these circumstances water was not fetched and stored and therefore not accounted for during the research process. Also, in areas with yard connections people pointed to occasional consumption of water directly from the tap, mainly for drinking or personal hygiene. This type of consumption was not recorded.

- Underestimation is also likely to happen in the calculation of water used for washing clothes. The pattern of consumption involving laundry activities was investigated separately because it is not a daily activity. Under-estimates and therefore unquantifiable washing may arise from the fact that some women use nearby rivers and spring for washing and recording of the use is complicated by the fact the some of the activities such as rinsing are directly carried out in the stream. In villages such as Township, Tsakane, and Violetbank, women reported using nearby rivers and springs for washing clothes. In Township, 30% of the women interviewed reported using the Klein-Sand for washing. Some of them expressed their preference for using the river as a way of socializing with their neighbours and getting away from home.

3.4 WATER CONSUMPTION IN FULLY SERVICED HOUSEHOLDS

Although it was not the primary concern of the research, a limited amount of fieldwork was carried out to assess consumption in fully serviced rural households and townships in the research area. The results of the enquiry are presented in this section and provide an indication of consumption patterns for levels of service higher than yard tap connection

3.4.1 House to house connections

Four households with house to house connections were part of the sample. One household in Dingleydale and another one in Xanthia were selected for determining consumption for basic needs. They agreed to monitor their water consumption for basic human needs during three days under the agreement that their names would not be mentioned in the final research report. Connections were metered in both households and the meters had been installed by the homeland government but they had never been issued a bill for water use.

Both households had taps in the kitchen and a bathroom/shower. Neither had access to flush toilets and they made use of pit-latrines. Both households had access to extensive lawns and vegetable garden and indicated that they also used the connections to irrigate both lawn and vegetable garden. During the days of the study neither the garden nor the lawn were to be watered and therefore all consumption was to be considered "basic needs". After three days the meters were monitored and the results in litres per person per day are provided in table 3.5.

Table 3.5
Basic needs consumption in two fully serviced households in rural Bushbuckridge

Village	Consumption[4] (litres/person/day)
Dingleydale	114
Xanthia	85

Consumption in these households is four times higher than the average for the village (21 l/c/d) in the case of Xanthia, and five times higher in the case of Dingleydale (22.4 l/c/d). Although the results from two observations cannot be generalised to all fully serviced households in the area, they illustrate the tendency to much higher consumption patterns when the household has access to kitchen connections and some type of in house bath facilities.

3.4.2 Water consumption patterns in Dwarsloop

Dwarsloop is one of the declared townships in the Bushbuckridge area. An initial meeting was organised through the BBR Midlands local government. 11 people attended the meeting and the discussions centered on general water use patterns in the townships, institutional arrangements regarding water provision and problems and constraints to water supply in the town. Appendix 3.3 provides a summary of the outcomes of the meeting.

In order to determine the average domestic water consumption in Dwarsloop, 41 water bills covering the period 18/2/98 to 18/3/98 were randomly chosen from available records at the Town Manager Office. Each statement reflected consumption of water for the previous month, the total bill and whether the client's account was in arrears[5]. The analysis of the statements yielded the following results summarised in table 3.6. Two observations were dropped from the analysis due to inconsistencies in the readings. Two other observations indicating very high consumption of 239 m^3 and 528 m^3 were treated as outliers

[4] Consumption figures for these households were treated as outliers and therefore not included in the statistical analysis of the data.
[5] Dwarsloop council charges for water using a block-rate tariff. R0.2 per m^3 is charged for initial 50 m^3 and R0.3 per m^3 thereafter (for a discussion on prices for water in Bushbuckridge see chapter 6)

Table 3.6
Statistics for water consumption in Dwarsloop.
February - March 1998

	M^3 per hh.	**Litres/capita/day***
Mean consumption	34	202.4
Median	27.5	163.7
Standard deviation	28.6	170.5
% of accounts in arrears	83%	

* Litres per capita per day calculated using an average of 5.6 individual per hh

Table 3.6 indicates that daily per capita average consumption in the Dwarsloop is close to 200 litres, which includes basic needs and other uses such as car washing, irrigation of lawns and gardens. The following facts must be taken into account in relation to the figures above:

- Plots allocated by the Dwarsloop municipality are all equipped with yard connections from which in house to house connections and water-borne sewerage systems can be established. Levels of service vary from a minimum of yard connection to fully connected households with kitchen connections, bath/shower and flush toilets.

- There are significant differences in consumption levels between sections of Dwarsloop. Monthly household consumption in the sample varied between 1 m^3 and 125 m^3, and hence average consumption figures need to be treated with caution as they smooth out the realities faced by different households.

- Although there is a formal revenue collection system in place defaulting payments is the norm for most households, and the municipality lacks the resources and/or the ability to enforce regulations. There is no incentive to save water and it is quite common to observe people sprinkling their lawns and garden in the middle of a hot summer day, and being generally careless about the amount of water they consume.

3.5 AN ASSESSMENT OF THE FIGURES FOR 'BASIC NEEDS'

The absence of water meters devices in most of the households in the sample has been already noted. Therefore, in order to asses the quality of the consumption figures provided by the interviewees, it was decided to compare the data collected with consumption figures reported in the literature for the area and other similar areas in the country.

In general, data for 'basic needs' consumption obtained in the research correlate well with the figures reported in the literature:

In a study examining household's water consumption in the Inadi ward (former Kwazulu), Peter G. Alcock (1986) provides some figures for mean per capita water consumption for black rural and peri-urban areas in Southern Africa. Table 3.7 summarises data from this study:

Consumption figures for the former Lebowa homeland (part of which falls within Bushbuckridge) corresponds very closely with the range of figures obtained in this research (see table 3.3). Consumption for basic needs in the Inadi ward stays very close to the mean consumption for basic needs excluding washing clothes in this study (16 litres per capita per day). However comparisons must be tentative due to the differences in topography and socio-economic profiles between the two areas. This is also the reason offered by Alcock to explain the differences between his figures for the Inadi ward and those from the Valley of the Thousand Hills also in the former Kwazulu (11 litres).

Table 3.7
Mean per capita water consumption for black rural Southern Africa
(P. G. Alcock, 1986. Own elaboration)

Geographical location	***Comments***	***Mean water consumption (litres per capita per day)***
Former Lebowa	Rural villages with boreholes	20
Lesotho	Rural villages: source-derived water and limited reticulation from protected springs	18-24
Former KwaZulu	Valley of Thousand Hills: source-derived water and limited reticulation from protected springs	11
Former Transkei	Rural villages: largely source derived water	10
Former Ciskei	Rural villages: largely source derived water	9
Inadi ward (former Kwazulu)	Unprotected and protected springs, rivers, dams and stored household water	15.6 (Only potable consumption. It does not include laundry)

In a recent report for the Water Research Commission, A. Van Schalkwyk provides some guidelines for the estimation of domestic water demand in developing communities in the Northern Transvaal (now Northern Province). Estimations are based on existing surveys, reports of the area, and also monitoring consumption (A. Van Schalkwyk, 1996). He argues that water demand for domestic purposes is strongly related to the economic and "level of living" status of the consumer. He proposes a classification of communities according to a 'level of living index' (or development level) constructed from a group of indicators that relate to water demand (income, education, housing type, gardening activity, agricultural activity, population, business activity, electricity connections, private connections and household size). Water demand is then estimated for each of the 8 categories or levels of living. Appendix 3.4 shows details on the "level living index" for each category. Table 3.8 shows the amount of water used in 'basic consumption' for the 8 levels of living in the study.

The classification in table 3.8 refers to villages as a whole. Water demand figures presented in the table as benchmarks for comparison with the consumption figures obtained in this research. Although the heterogeneity of villages in this does not allow for an easy allocation of villages into Van Schalkwyk´s categories, most households in our sample of villages would belong to one of the first five levels in the table (Level 0 (Subsistence), Level 1 (Very Low), Level 2 (Low) and Level 3 (Low to Moderate), with some few households in each community in Level 4 (Moderate) and Level 5 (Moderate to high).

Table 3.8
Summary of water required for domestic activities for the different levels of living
(A. Van Schalkwyk, 1996. Own elaboration)

Level of living index	Water use (l/c/d)							
	Drink/ cook	Dish Wash	House Wash	Clothes Wash	Bath/ Shower	Toilet	Total	Total - Clothes wash (our HC)
0	3	2	1	2	7	0	**15**	13
1	3	2	1	3	15	0	**24**	21
2	3	2	1	3	16	0	**25**	22
3	4	3	1	4	20	0	**32**	28
4	4	4	2	4	40	0	**54**	50
5	4	6	2	5	60	5	**82**	77
6	4	10	3	6	92	30	**143**	137
7	4	15	5	8	163	40	**235**	227

As a general observation, consumption figures for basic needs derived in this study are lower than the estimated demands at the equivalent levels of living used by Van Schalkwyk. The range of variation for our human consumption variable (HC) is between 15.1 to 20.8 l/c/d for the "best case scenario" villages, and between 14.1 to 19 for the "worst case scenario" villages (see table 3.3). Therefore, our average household in all case study villages would be placed between levels of living 0 and 1. This seems to contradict our initial observations that most households in our sample fall between levels of living 0 to 3 with some in level 4. Possible explanations for these differences are:

- Average consumption figures presented in table 3.3 hide the level of variation in consumption between households in the same community.

- Demand figures provided by Van Schalkwyk are aimed estimate water demand of communities and include allowance for losses between the source and the consumer. In contrast, figures derived in this study are estimations of direct consumption and do not account for water losses in supply and transfer from collection point to home. Therefore, figures in this study can be expected to be generally lower.

- A closer comparative analysis of the figures reveals that consumption figures for washing clothes in this study (W) are in range from 3 to 7 litres in all communities, and therefore cover the spectrum of levels of living from 1 to 5. Therefore, it must be in the HC component of "basic needs" that the differences with Van Schalkwyk´s figures arise.

- Furthermore, the main differences are likely to lie in the estimation of water for personal hygiene (included in our variable HC, and in the column titled "bath and shower" in Van Schalkwyk's estimations). Given that water demand for drinking, cooking and household cleaning shows the lowest variation with the increased level of living, we can assume that the number of litres for drinking, cooking and household washing are similar to those provided in table 3.8 (for the levels of living 0 to 4 this demand ranges between 5 and 10 l/c/d). Under this assumption and given the HC class averages in table 3.3 (17.6 and 16.8 l/c/d respectively), consumption for personal hygiene will therefore vary between 7.6 and 12 l/c/d for the "best case scenario" villages, and between 6.8 and 11.8 l/c/d for our "worst case scenario" villages. Once again, these figures are comparable to the "bath and shower" demand for levels of living 0 to 1 in table 3.8, and not to the levels of living 0 to 4 were it was hypothesised most households would be. Nevertheless, the tendency to underestimate the number of litres for personal hygiene noted during fieldwork process, and mentioned in the limitations to the data (section 3.3.3 of this chapter) can be an explanation for these differences.

In a recent paper which looks at household water resources and rural productivity in Sub-Saharan Africa, S.Rosen and J.R. Vincent review several studies that provide estimates of the quantity of water used by rural African households that obtain water from a source away from the household (S.Rosen and J.R. Vincent, 1999). Figures quoted in the study vary significantly from country to country. The lowest consumption figure encountered is 4.1 litres per head/day in a village in Mozambique, where people had to walk 4 km a day to the source. The highest (80 litres per head and day) belongs to a Kenyan district located in the highlands and receiving substantial rainfall. They do not offer figures for South Africa. In their conclusion, and based in the " four best available" studies they found, they suggest 10 litres per person per day as a rough average for the use of water in rural areas. They nevertheless indicate that the range in these four studies is great, varying from 1.3 to 48.5 litres/capita/day, and they also recognize that there is a great variation between countries, villages and even households within the same village.

3.5 CONCLUSIONS AND POLICY ISSUES

1. Results for the Bushbuckridge area indicate that where the maximum level of service is a yard tap, an average of **19 to 27 litres of water per person per day** are consumed for basic domestic needs including human consumption, cooking, cleaning household, washing dishes and washing clothes (see table3.3).

2. **Consumption seems to increase dramatically with higher levels of service**, particularly if the household has access to shower/bath and water-borne sewerage systems, and the service is provided at no cost to the consumer. (See table 3.5 and 3.6)

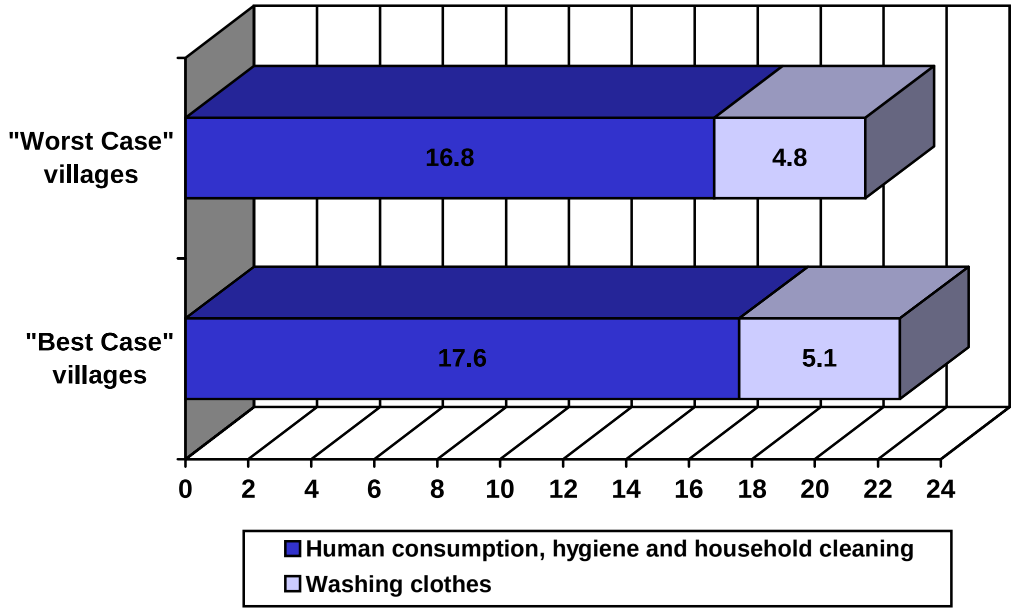
3. Current South African legislation gives emphasis to the provision of 25 litres/capita/day as the minimum standard of supply for all South Africans (RDP standards). This has been the objective of most of the delivery effort undertaken by the government since 1994. Research results presented here indicate that given yard tap connection as the maximum level of supply and current consumption levels, **basic human needs are covered within the first 25 litres/capita/day** (see figure 3.1)

4. The reverse is that the 25 litres/capita/day seems to **just cater for human consumptive activities**. As we will see in the next chapter, **economic activities using domestic water occur over and above the first 25 litres**. A clear policy implication arising from this fact is that, if one of the objectives of securing access to water for rural inhabitant is to improve the range of economic options available to impoverished rural South African, this will only start happening if they are able to access quantities of water over and above 25 litres/capita/day.

5. Furthermore, given the water sector's growing concerns about cost recovery and **sustainability**, the ability of the rural poor to access increasing amounts of water quantities will not just be determined by the availability of the water (supply side) but mainly by his/her ability carry to the cost the water and its supply (effective demand / ability to pay). The ability to pay, in turn, can only be enhanced by increasing the economic opportunities of the rural poor, and as we have seen before, the availability of **water over and above 25 litres/capita/day may be a necessary condition for this.**

6. Rural water sector policy should not be driven by the supply of "basic needs" but also by the economic opportunities that the access to domestic water can generate in rural areas. Breaking the vicious circle depicted above will be one of the main challenges facing the rural water sector in the next decade.

Figure 3.1
Mean consumption for Basic Needs in both research categories (litres/capita/day)



CHAPTER 4
USE OF DOMESTIC WATER FOR ECONOMIC ACTIVITIES

4.1 INTRODUCTION

Domestic water in Bushbuckridge is used for a combination of “basic needs” and productive uses. This chapter presents and analyses consumption figures for productive uses of domestic water. The term “water-dependent low-level economic activities” is used throughout the research to refer to the productive uses of water (see definitions in chapter 1, section 1.5). It refers to the use of water to generate an income for example growing vegetables, fruit trees, livestock rearing, brewing beer, building activities, ice-block making. While some of these activities are lifestyle improvements (as opposed to profit orientated activities) they provide goods and services for poor households, and for some households this forms an important element in their livelihood strategy.

The chapter analyses water consumption for each activity independently. The percentage of households involved in each activity is calculated and the patterns of water use are explored for households and individuals. The method used to estimate activity specific consumption figures is described in the relevant section. The statistical significance between “worst case” and “best case” scenario villages are also explored.

Average per capita/day consumption figures for all economic activities are added for each case study village in order to produce a profile of domestic consumption for an average individual in each village.

4.2 VEGETABLE GARDENS

4.2.1 General considerations

This category refers to small portions of land used to grow vegetables and field-crops. These gardens, as opposed to other agricultural land, are normally located within the individual homestead and are irrigated with domestic water. They are also referred to as “private gardens” to differentiate them from communal or community gardens. People normally grow vegetables such as tomatoes, cabbage, lettuce, pepper, in the winter and field-crops such as maize, groundnuts, and cassava, in the summer, with the rains. Most of the produce is for household consumption, but some is sold in local and regional markets.

Private gardens are generally small (30m^2 to 600m^2…) and the amount of time and effort dedicated to them varies from household to household. 'Private garden's' have a range of functions, as a main source of food for consumption, to generate an income or as a food supplement.

The existence of private vegetable gardens (particularly during winter) is an indicator of the status of the domestic water supply in a village. In most “best case scenario” villages, most households were growing vegetables. Conversely, in “worst case scenario” villages, the inability to undertake gardening activities due to the lack of water was one of the first concerns (together with long walking distances and queuing to fetch water) that villages raised when discussing the water situation for the village. Also, people indicated that vegetable and fruit production were the first activities that they would undertake if they had access to improved domestic supplies.

Finally, it must be mentioned that although communal gardens are also common in Bushbuckridge, they were excluded from the research, as they are not normally irrigated with domestic water.

4.2.2 Water consumption for vegetable gardens

Irrigation practices for vegetable gardens vary from household to household, reflecting differences in the availability of water and knowledge of gardening practises. Whenever possible the approach used to calculate water consumption was to obtain a direct estimation of the amount of water used, irrigation patterns and the seasonal variations.

However, this was only possible in villages were people irrigated manually using buckets and reasonable estimates could be made. In areas were people had access to yard connections, irrigation of gardens was done with hosepipes connected to the un-metered taps. Water flows from yard taps were not constant and households had problems estimating the time spent irrigating the garden as it would often be carried out by several members of the household at different times. In these cases, the size of the garden was measured and water consumption was estimated using a conservative irrigation scenario of 1000 mm/ha per annum (2.74 litres per m^2/day) based on extensive consultation with the Africa Agricultural Research Council (ARC, Pers. Comm). This figure correlated with the estimates of consumption obtained from households for which data on water use for irrigation was available. For example, in Shortline, a village where most household irrigate using buckets, the amounts of water recorded varied from 1 litre/m^2 to 5.7 litres/ m^2, with an average of 2.5 litres/ m^2. In M&B, where a community garden, managed by a group of women, varied from 3.4 litres/m^2 to 7 litres/m^2 with an average of 3.5 litres/m^2.

4.2.3 Data analysis and results

4.2.3.1 Results for households with gardens

Table 4.1
Percentage of sample households with a vegetable garden in their homestead, and average irrigation for these households (litres/capita/ day)

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH with Garden**	**n_{12}**	**Average l/c/day**	**Average l/c/day**	**n_{22}**	**% HH with Garden**	**n_{21}**	**Village**
Shortline	18	44%	8	33.3	6.6	16	39%	41	Violetbank F
Dingleydale	66	33%	20	14.8	0	0	0%	39	Township
Boshoek & Matefeni	61	65%	31	34	17	7	43%	16	Itereleng
Utha	5	80%	4	18	2.2	1	5%	18	Dixie
Xanthia A	25	36%	4	34.9	2.6	4	9%	43	MP Stream C
Kildare B	28	32%	6	87.2	0	0	0%	12	Mabharule
					3.7	1	3%	27	Tsakane
Total n	203		73			29		196	**Total n**
Class average*		**45% m_{11}**		**32.2 m_{12}**	**8.3 m_{22}**		**14% m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

Table 4.1 shows the percentage of households with gardens in each of the case study villages and average water consumption per capita/day in these households. 45% of all sample households in "best case scenario" villages were growing vegetables at the time of the interview, whereas only 14% of households in "worst cases scenario" villages were doing so. Also, the average water consumption per day for irrigation was much higher in "best case" villages (32.2 l/c/d) than in "worst case" villages (8.3 l/c/d).

Possible reason for the apparent anomalous results for Violetbank F and Itereleng, both "worst case villages" with a higher percentage of households involved in gardening than some of the "best case" villages are as follows:

- Violetbank F is a new settlement. Most people living in the section are new comers to the area, mainly young couples trying to start a family. Construction was widespread throughout the village (see section 4.4) and most households were trying to start gardening activities. However, access to water was limited and most gardens struggled to survive during winter.

This is confirmed by the low figures of water used for irrigating the gardens shown in table 4.1. On average they used only 6.6 l/c/d compared to the 32.2 l/c/d average for the "best scenario" category.

- Itereleng is a very small section of a much bigger village called Goromane. Situated in south western Bushbuckridge, one of the highest rainfall within the district, and is also close the perennial Sabie-River. Water supply in Goromane is generally very good, and Itereleng is worse-off section of the village in terms of access to water. However, most households have yard taps and when there is sufficient pressure water reaches Itereleng. Itereleng was selected as a "bad case" study to compare it to the best section of the village (B&M). However, when compared to other "worst cases" in our sample, general availability of water is much better than in the others and therefore, consumption for some of the activities is likely to be higher than the average "worst case"

The average amount of water used for irrigating gardens in Kildare (87 l/c/d) is nearly three times higher than the average figure for all "best case" villages. This is due to the existence of some very large vegetable gardens in the village that are very close to the main source of water for the area.

Table 4.1 indicates the high proportion of households with gardens in Utha (80%). However, this figure is based on five observations and its statistical significance is therefore limited. It must also be noted that the impact of Utha's average in the estimation of the overall average percentage of household with gardens for all "best case" villages is very limited because the combined average for the category has been weighted as indicated in table 4.2. When the observation for Utha is dropped, the overall mean (m_{11}) only drops by 1% (m_{11}=44%), and therefore the impact on the overall analysis is negligible.

The following analysis were conducted on the data in order to elucidate whether the differences between "best case" and "worst case" scenario shown in table 4.1 were significantly different:

- In order to test whether the proportion households having access to a vegetable garden was significantly higher in "best case" villages than in "worst case" villages two "sample t-test" was conducted. Proportion data was transformed through an arcsine function. The results indicate that the proportion of households with a vegetable garden in their homestead tends to be significantly bigger ($t = 3.29$, $p=0.007$) in "best case" scenario villages.

- Households with vegetable gardens in "best case" scenario villages tend to use a significantly higher amount of water ($t=4.28$, $p=0.00004$) to irrigate their gardens than households in "worst case" villages.

4.2.3.1 Results for all households (with and without gardens)

Table 4.2 shows the average consumption for the irrigation of vegetable gardens for all individuals and households in the village (with and without gardens). Average consumption figure for "best case" villages (12.1 l/c/d) is significantly higher (K-S =8.3, $p=0$) than for "worst cases" (1.2 l/c/d). In this case, and because normal distribution of the data could not be assumed, a non-parametric Kolmogorov-Smirnov two-sample test was used to test the null hypothesis of no difference between the mean consumption in "best case" versus "worst case" villages.

Table 4.2
Irrigation of vegetable gardens.
Average water consumption for all people in all households (litres/capita/ day)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**n_1**	**Average l/c/d**	**Average l/c/d**	**n_2**	**Village**
Shortline	18	14.8	2.6	41	Violetbank F
Dingleydale	66	4.5	0	39	Township
Boshoek & Matefeni	52	20.3	7.5	16	Itereleng
Utha	5	14.4	0.1	18	Dixie
Xanthia A	20	7	0.2	43	MP Stream C
Kildare B	25	20.9	0	12	Mabharule
			0.1	27	Tsakane
Total n_1	186			196	**Total n_2**
Class average		**12.6 m_1**	**1.2 m_2**		**Class average**

* Note that all class averages (m_1 and m_2) are weighted averages (weights calculated as the proportion of village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.2.4 Conclusions

It must be stressed that availability of water is not the only factor that influences household's decision on whether to engage in gardening activities or not. Not all households in villages with access to water supply have vegetable gardens in their homestead. Factors that also govern this decision are: access to credit, markets, labour, land, the existence or not of a community garden in the village, and the way in which gardening activities feature in the overall livelihood strategy of the household. Measuring the relative importance of these factors was not within the scope of this research. Assuming that all these factors remain constant and/or are equally advantageous or disadvantageous to all households then, the following conclusions can be drawn:

- Households in "best case" villages have a significantly better chance of growing a vegetable garden. On average that probability will grow from 14% in "worst case" villages, to 45% in "best case" villages.

- Households with gardens in "best case" villages tend to use a significantly higher amount of water for the irrigation of their gardens. On average that amount will increase from 8 l/c/d "worst case" villages, to 35 l/c/d in best case villages.

- Assuming an average household size of 6 people, and a moderate irrigation scenario that requires 2.4 l/d/m^2 for the garden to be productive, households in "best case" villages will be able to support gardens of 88 m^2 of average size, whereas the maximum average size in "worst case" villages will be 20 m^2 only.

- Finally, if we consider all households in the village, and not only those with gardens, under current consumption levels, householders in the "worst case" scenario villages are likely to use an average of 1.8 l/c/d for the irrigation of vegetable gardens, whereas individuals in "best case scenario" villages are to use 12.6 l/c/d.

4.3 FRUIT TREES

4.3.1 General considerations

Householders grow trees within their homestead area either for self-consumption or for marketing in local and regional markets. The most common types of fruit trees are mango, litchi, banana, paw-paw, avocado, guava and peach. The existence of fruit trees as a crop can be a good indicator of the water supply situation of a particular village. However, trees will survive long periods without water, particularly if they are adult trees. Also, since trees provide other services such as shade they are common even in villages with poor domestic supply, but they are less likely to be productive. Irrigation patterns for trees also vary, with some people irrigating daily whereas others only irrigate occasionally. Fruit trees are also very common recipients of "grey water".

4.3.2 Water consumption for fruit trees

The following steps were undertaken to calculate the amount of water used for the irrigation of fruit trees:

1. The number of fruit trees within each compound was recorded. Barren trees were not included, as people tend not to irrigate them.
2. The minimum weekly water consumption for a fruit tree to be productive was estimated as 40 l/tree (ARC pers. com., 1999), and this factor was used in households where the amount of water used for irrigating trees could not be estimated.
3. The validity of this assumption was assessed by comparison with the recorded consumption in households where it was possible to estimate irrigation patterns. Table 4.3 provides an indication of recorded weekly consumption per tree for different villages. Consumption varies widely from 1 l/week of one household in Violetbank F to 175 l/week for a household in Shortline and Tsakane.

Table 4.3
Recorded irrigation of trees (l/tree/week)

Village	Range	Mean
Shortline	6.3 - 175	41
Dingleydale	2.4 - 70	23.3
Boshoek & Matefeni	11.2 - 40	24
Xanthia A	4.3 - 50	21
Kildare B	2 - 75	27
Violetbank F	1 - 14	10
Township	6.3 - 75	30
Itereleng	20 - 26.6	22
Tsakane	6 - 175	36

4. Not all households had fruit trees. Consumption figures were calculated for households that irrigated trees, and also for all households in the sample (whether they had fruit trees or not).

4.3.3 Data analysis and results

4.3.3.1 Results for households with trees

Table 4.4 shows the percentage of households with fruit trees in each of the case study villages, and the average number of fruit trees per household. It shows that most households have fruit trees in their plots. In "best case" scenario villages 90% of the households have trees whereas in "worst case" villages the average proportion declines to 72%. Once again Itereleng stands out amongst the "worst case" scenario villages with all the interviewed households having fruit trees. If Itereleng is dropped from the "worst case" category, the average percentage of households with fruit trees decreases to 69%. Due to the reasons explained in the section on vegetable gardens

(4.2.2), excluding Itereleng may result in a figure that is more representative of the situation in "worst case" scenario villages as a group.

Table 4.4
Households with fruit trees

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH with trees**	**n_{12}**	**Average number of trees**	**Average number of trees**	**n_{22}**	**% HH with trees**	**n_{21}**	**Village**
Shortline	18	94%	17	12	17.4	11	56%	23	Violetbank F
Dingleydale	25	80%	20	12.3	10.8	32	86%	37	Township
Boshoek & Matefeni	35	97%	34	18.6	13.8	13	100%	16	Itereleng
Utha	-	-	-	-	4.2	9	50%	18	Dixie
Xanthia A	24	96%	23	11	-	-	-	-	MP Stream C
Kildare B	28	86%	24	17.9	8.6	3	25%	12	Mabharule
					13.7	22	88%	26	Tsakane
Total n	130		118			90		132	**Total n**
Class average*		**90%** **m_1**		**15** **m_{11}**	**12** **m_{22}**		**72%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

Household with trees in "best case" scenario villages average 15 trees per household, compared to 12 trees per household in "worst case" villages. Violetbank F and Itereleng are outliers within the "worst case" category. The reasons for this are the same explained in the section on vegetable gardens (see 4.2.3). Also in the case of Violetbank F, the average number of trees does not correlate with an equally high figure for irrigation. Less than half of the household with trees in Violetbank irrigate them, and the amount for water per capita/day used to irrigate trees is one of the lowest for all the villages in the "worst case" category (see table 4.5).

A series of Two sample T-test were conducted in order to test whether the differences in Table 4.4 were statistically significant. Data on the proportion of households with trees followed a binomial distribution and was therefore transformed through an arcsine transformation. Data on the number of trees per household was not normally distributed and was log transformed in order to be able to conduct the t-test.

The results of the test show that at 95% confidence there is no significant difference in the proportion of households having trees ($t=1.40$, $p=0.19$), or in the number of fruit trees per household ($t=1.77$, $p=0.07$)[1] between the worst case and best case villages.

Nevertheless, differences in the households with trees and number of trees per households notwithstanding, the main differences between "best case" and "worst case scenario villages are likely to occur in the amount of litres that are used to irrigate trees. Table 4.5 present figures on the proportion of households that irrigate trees and the number of litres used by these households.

[1] Note that the difference would be significant at 93% level. The calculated t-statistic is just on the limit of the rejection zone for the null hypothesis

Table 4.5
Percentage of households that irrigate trees and per capita water consumption (litres/capita/ day)

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH irrigate trees**	**n_{12}**	**Average l/c/day**	**Average l/c/day**	**n_{22}**	**% HH irrigate trees**	**n_{21}**	**Village**
Shortline	17	70%	12	10.8	2.3	6	46%	13	Violetbank F
Dingleydale	20	90%	18	10.6	2.1	5	17%	30	Township
Boshoek & Matefeni	34	68%	23	15.2	10.1	6	47%	15	Itereleng
Utha	-	-	-	-	3.3	9	100%	9	Dixie
Xanthia A	23	61%	14	9.9	-	-	-	-	MP Stream C
Kildare B	24	79%	19	14.9	5.4	1	33%	3	Mabharule
					6.4	9	43%	21	Tsakane
Total n	118		86			36		91	**Total n**
Class average*		**73%** **m_{11}**		**12.7** **m_{12}**	**4.4** **m_{22}**		**41%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

For the "best case" villages, 73% of the households with fruit trees indicated that they irrigated their trees, whilst 41% irrigated in "worst case" villages. Also, in villages with relatively better domestic water supply, individuals use an average of 12.7 l/c/d in irrigating their fruit trees, whereas individuals in households with trees in the "worst case" scenario villages use 4.4 l/c/d in their trees. For "worst case" villages this water is likely to be mainly "grey water".

The difference in the proportion of households that irrigated trees between "best case" and "worst case" scenario villages was not statistically significant at 95% confidence level (t=1.25, p=0.23). However, the amount of water used to irrigate trees was significantly higher in "best case" villages (t=2.65, p=0.009) than "worst case" villages. Therefore, with the available data it cannot be concluded that owner of fruit trees in "best case" scenario villages are more likely to irrigate their trees than those in "worst case" villages. However it can be said with a 99% certainty that those in "best case" village use a significantly greater amount of water for their trees than those in "worst case" villages.

4.3.3.2 Results for all households (with and without trees)

Finally, table 4.6 presents the average number of fruit trees and the average consumption for all households in the sample. Households in "best case" scenario villages have an average of about 14 fruit trees and use an average of 8.5 l/c/d in irrigating them. In "worst case" scenario villages households tend to have 8 fruit trees and use 1.4 litres/capita/day irrigating them. In this case, and because normal distribution of the data could not be assumed, a non-parametric Kolmogorov-Smirnov two-sample test was used to test whether the differences between the average number of trees and also between the average consumption in "best case" versus "worst case" scenario villages were significant. Both the differences in the average number of trees (K-S=2.23, p=0.0), and the differences in average use of water (K-S=5.66, p=0) were significant.

Table 4.6
Average number of trees for all hh in the village and average water consumption for all households (with or without trees, irrigate or not) (litres/capita/day)

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**Average number of trees**	**n_{12}**	**Average l/c/day**	**Average l/c/day**	**n_{22}**	**Average number of trees**	**n_{21}**	**Village**
Shortline	18	11.4	18	7.2	0.6	23	9.1	21	Violetbank F
Dingleydale	25	9.9	24	7.9	0.3	35	9.4	37	Township
Boshoek & Matefeni	35	18.1	35	10	4.3	14	12.4	15	Itereleng
Utha	-	-	-	-	1.6	18	2.1	18	Dixie
Xanthia A	24	10.6	24	5.8	-	-	-	-	MP Stream C
Kildare B	28	15.3	28	10.1	0.4	12	2.2	12	Mabharule
					2.4	24	12.2	26	Tsakane
Total n	130		129			126		125	**Total n**
Class average*		**13.6** **m_{11}**		**8.5** **m_{12}**	**1.4** **m_{22}**		**8.6** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.3.4 Conclusions

Most households keep some fruit trees in their homesteads. Their ability to irrigate them determines the productivity of these trees and therefore the benefits that the household accrues . As in the case of the vegetable gardens water may not the only factor determining whether to plant fruit tress. However, if all other factors remain constant and/or are equally advantageous or disadvantageous to all households then, the results indicate that, under current circumstances and consumption levels, people in "worst case" scenario villages are likely to use and average of 1.4 litres of water/capita/day for the irrigation of their fruit trees (mainly grey water). On the other hand, individuals in "best case scenario" villages are likely to put as much as 8.5 litres of water per day to the same use. This in turn means that:

- Households in "best case" scenario villages tend to have a significantly higher number of fruit trees in their homesteads, with average the number of trees increasing from 8.6 per household in "worst case" villages to 13.6 per household in best case villages.

- Assuming an average household size of 6 and an irrigation regime of 40 litres a week per tree:
  - Under current water use practices (8.5 l/c/d) households in "best case" villages are able to productively support an average of 9 trees per household.
  - Under current water use practices (1.4 l/c/d) households in "worst case" villages are able to productively support an average of 1.5 trees per household.

- From the last two points it follows that out of the 13.6 trees per households in "best case villages only 9 trees (66% of the fruit trees) are irrigated to their minimum productive level. An extra 26 litres per household per day (4.3 l/c/d) would be needed to bring those trees to their minimum productive level.

- In the case of households in "worst case" villages, only 1.5 trees (17% of the fruit trees) are irrigated to their minimum productive level. An extra 40 litres per household per day (6.7 litres/capita/day) would be needed to bring those trees to their minimum productive level. These last point confirms the perceptions gathered from people in "worst case" villages that they hardly ever irrigated fruit trees and that they mostly get recycled water (grey water). Only in exceptionally dried periods they are irrigated in order to keep them alive.

4.4 CONSTRUCTION

4.4.1 General comments

Most people in rural communities in Bushbuckridge build their own homes. Even though a professional builder is frequently hired to assist in construction, it is normally the owner of the house who buys the materials and makes his/her own cement bricks. Domestic water is normally used in the process. Building a homestead is an ongoing process for most families. Households extend their living space when need arises, hence, some building activity happens nearly every year in any given household, mainly during the rainy season when more water is available.

Building was considered as one of the economic uses of domestic water because, although it is not normally done for business, and therefore it does not translate into a monetary income for the household, it provides housing services that would have to be hired or bought otherwise.. In addition, some households make cement bricks for sale.

4.5.2 Water consumption for construction

In order to calculate the quantity of water used by a household for building, the following assumptions, based on information provided by interviewees, were made:

- 1 bag of cement uses 125 litres of water and produces an average of 37 bricks.
- The average room (3.5 m x 3.5 x 2.5 m) needs 33.5 bags of cement. This includes cement for foundations, floor, bricks, and internal and external plaster.

With these assumptions, the process for calculating consumption was the following:

1. Households were asked the number of bags of cement they have used in the six months previous to the interview. This amount was multiplied by 125 litres of water per bag
2. Where this data was not available , the construction work done during the period of reference was measured and compared to the estimated average number of bags per room provided above.
3. In the case of people who made cement bricks for sale, the amount of cement used for this was added to the total amount of cement used by household, and therefore, water used for this type of business is accounted for in our estimations

One limitation of this approach is that some of the water used in building was not accounted for. Although most people use cement to build their houses, some households (mostly the poorest ones) still build in the traditional style using mud. Water used for this type of building practises was not considered and therefore figures for building presented in the research are likely to be underestimated.

4.4.3 Data analysis and results

4.4.3.1 Results for households that built

Table 4.7 shows the percentage of households that did some building in the six months previous to the interview, and the average number of bags of cement t used. The results indicate that:

Table 4.7
Households that did some building six months prior to the interview, and the cement used

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH that built**	**n_{12}**	**Average bags of cement**	**Average bags of cement**	**N_{22}**	**% HH that built**	**n_{21}**	**Village**
Shortline	16	31%	5	16	49.6	20	71%	28	Violetbank F
Dingleydale	41	71%	29	83.6	29.7	9	25%	36	Township
Boshoek & Matefeni	59	46%	27	58.1	20.5	6	37%	16	Itereleng
Utha	66	74%	49	36.5	30.1	17	68%	25	Dixie
Xanthia A	23	43%	10	33.2	30.1	23	41%	56	MP Stream C
Kildare B	26	42%	11	19	14.4	9	25%	88	Mabharule
					18.7	13	50%	26	Tsakane
Total n	231		131			110		275	**Total n**
Class average*		**57%** **m_{11}**		**48.9** **m_{12}**	**28.6** **m_{22}**		**40%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

- 57% of households in "best case" villages used an average of 49 bags of cement for construction, whereas 40% of households in "worst case villages used an average of 29 bags.

- In all pairs of villages except for the Shortline /Violetbank F , the proportion of households that engaged in construction is higher in the "best case" than in the "worst case". The same is true for the average number of bags of cement used. In the case of Violetbank F the reasons for this anomaly have been explained before (see section 4.2) and are mainly due to the fact that it is a very new settlement in which most families are still building their households.

The following test were conducted on the data in order to elucidate the statistical significance of any differences between "best case" and "worst case" scenarios (table 4.7) :

- In order to test whether the proportion of households that built was significantly higher in "best case" villages than in "worst case" villages a two sample t-test was conducted. Proportion data was transformed through an arcsine function. The results from the t-test indicated that, at 95% confidence level, the difference in proportion was not statistically significant ($t= 0.57$, $p=0.57$) and therefore, it can not be concluded that households in villages with better access to water supply are more likely to build.

- Notwithstanding these results, if all other factors that may influence the decision to build were constant, it could be expected that households in "best case villages" are likely to build more than households in "worst case" villages, as this requires more water. In order to explore this, the differences in the number of bags of cement used by the two type of households was analysed. Data on the number of bags of cement used was not normally distributed and it was transformed through a $\log_{10}$ function. A two sample t-test was conducted on the transformed data and the results indicated that, at 95% confidence level, households in "best case scenario" villages are likely to build more or have bigger houses (use a significantly higher amount of cement ($t= 2.27$, $p=0.02$), and therefore a greater amount of water.

4.4.3.2 Results for all households

Finally, table 4.8 shows the average number of bags of cement per household for all households in the sample and the average number of litres used by each individuals across all households.

Households in “best case” villages used an average of 27.7 bags of cement, and the equivalent number of litres/capita/day of an average households with 6.1 members is 3.1. In “worst case’ villages the number of bags used by the average household is 11.4, and the equivalent number of litres/capita/day is 1.3.

Table 4.8
Average number of bags of cement for all households and average water consumption for all households (litres/capita/day)

“Best case scenario” villages				“Worst case scenario” villages			
Village	**n_{11}**	**Average bags of cement**	**Average L/c/d**	**Average L/c/d**	**Average bags of cement**	**n_{21}**	**Village**
Shortline	16	5	0.7	5.0	35.4	28	Violetbank F
Dingleydale	41	59.1	7.5	0.9	7.4	36	Township
Boshoek & Matefeni	59	26.6	2.6	0.9	7.7	16	Itereleng
Utha	66	27.1	3.4	2.7	20.5	25	Dixie
Xanthia A	23	14.4	1.6	1.1	12.3	56	MP Stream C
Kildare B	26	8	0.9	0.3	3.6	88	Mabharule
				1.1	9.3	26	Tsakane
Total n	231					275	**Total n**
Class average*		**27.7** **m_{11}**	**3.1** **m_{12}**	**1.3** **m_{22}**	**11.4** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

Once again these differences were tested to see if they were statistically significant. In this case as normality in the distribution of the variables could not be assumed, a non-parametric Kolmogorov-Simirnov two sample t-test was conducted on the data. The results indicated that both the difference in the amount of cement (KS=2.27, p=0.00) and the difference in the number of litres used were statistically significant.

4.4.4 Conclusions

Building is one of the main water-dependent activities the people undertake with domestic water. The availability of water is not the only factor that influences the decision to build, and the decisions are also based on the availability of time, disposable income, and the need to build or extend the existing dwelling.. The research did not investigate the relative importance of these factors on the decision to build. However, if all the other factor are equally advantageous or disadvantageous for all households, the following can be concluded:

- Households in both village scenarios are equally as likely to undertake some building activity. Based on the available data it appears that households in “best case” villages are no more likely to build than households in “worst case village”

- However, amongst the households that decide to build, those in “best case” scenario villages use more cement (49 bags of cement versus 29 bags), and hence use a significantly higher amount of water

- If we consider all households in the villages irrespective of them having built or not, households in “best case” villages are likely to use a significantly bigger number of bags of cement (27.7 versus 11.4) and therefore, use a significantly higher amount of water (3.1 l/c/d versus 1.3 l/c/d).

4.5 TRADITIONAL BEER BREWING

4.6.1 General comments

Brewing traditional beer is a common practise amongst most rural households in Bushbuckridge and is normally associated with functions, festivities, rituals and ceremonials. Normally, the beer produced for such events is not sold but given away to friends as family and/or consumed in the household. There was considerable uncertainty in estimating the amount of water used, as functions do not occur with any regular pattern and not all households brew for these events. In fact, brewing may only occur once or twice a year, and the amount of litres produced may also vary each time. These occasional production patterns were not considered in the research.

The research concentrated on households in each village that brewed beer as an income generating activity and therefore, brewed on a regular basis. Beer brewers tended to be women living in poor households and also pensioners and tended to form a significant proportion of household income.

Sources of information on traditional brewers was sparse due to negative perceptions of the activity. For example, in some areas beer-brewing businesses were regarded as an illegal activity and people were reluctant to disclose information on where the brewers lived and the amount they brewed. In many areas the brewing and selling of traditional beer was stigmatised as it normally involved hosting a "shebeen" (unauthorised bar). Brewing beer was also perceived as an indication of poverty and in several interviews, respondents indicated that they would only brew beer if they had no other income option.

Religion also played an important role in the decision to engage in the brewing business. Some churches prohibited alcohol consumption and this was cited as the main reason for the lack of commercial traditional brewers in some communities. This was the case in Shortline, a community that grew around a Nathareen Revival mission and where most households belonged to that church. Religion was also the main reason for the existence of only one brewer in M&B .

Households brewed different types of traditional beer. Some types of beer being seasonal. An example of the variation is provided in table 4.9. It presents a seasonal calendar for the production of different beers compiled during the discussions with a group of brewers in MP Stream C.

Table 4.9
Seasonal calendar for the production of traditional beer in MP Stream C

	Jan	Feb	M	Apr	M	Jun	Jul	A	Sep	Oct	N	D
Good one	10	0	6	15	10	10	15	?	?	?	8	10
Xintu (Mqomboti)	15	0	12	20	15	15	20	?	?	?	12	12
Monati	0	0	3	3	3	0	0	?	?	?	4	4
Marula	40	40	10	5	0	0	0	0	0	0	0	0

Figures in the table are an indication of the relative importance of each type of beer in each month (they are not actual figures for production). It can be observed that Marula and Monati beers are strongly seasonal and linked to specific celebrations and/or the availability of certain ingredients. The case of Marula is typical of a beer made out of the fruit of a tree (Marula tree). It is a very popular beer and traditionally it is not sold but given as a present or shared with friends. Brewers in MP Stream indicated that during the Marula Season, production focuses on Marula beer.

4.5.2 Approach used to calculate water consumption for brewing

Traditional beer-brewing is a highly localised business in that most communities have their own brewers. The size of the business tends to be determined by how big the village is and how many other competitors there are in the same market. Since brewing takes a few days and the beer has limited shelf -life, there is a tendency for the brewers to organise their activities so that not all of them brew at the same time. This ensures the distribution of the business opportunities amongst brewers, and the complete sale of their produce.

In order to calculate water consumption for brewing beer the following steps were followed:
1. Structured interviews were used where possible and the majority of brewers were happy to assist.
2. Brewing arrangements in each village were discussed with individual brewers and focus groups. The total amount of water brewed in each village was then calculated

4.5.3 Data analysis and results

4.5.3.1 Results for traditional beer brewers

Table 4.10
Brewing systems in each village

VILLAGE	NUMBER OF BREWERS AND BREWING SYSTEM	WATER USED PER BREWER (LITRES/BREW)
Shortline	No brewing in the village	-
Dingleydale B	4 brewers 2 brewers each week	All use 125 litres
Boshoek & Matefeni	1 brewer Brews every week	175 litres
Utha	3 brewers All brew each week	2 brewers use 200 litres The third uses 100 litres
Xanthia A	7 brewers All brew each week	All use 200 litres
Kildare B	7 brewers organised in two groups: **Group 1:** Brewer 1 and 2 brew twice/ month Brewer 3 and 4 brew three times/month **Group 2:** Brewer 5 and 6 brew twice/ month Brewer 7 brews once a month	Brewer 1 uses 575 litres Brewer 2 uses 350 litres Brewer 2 uses 525 litres Brewer 4 uses 500 litres Brewer 5 uses 425 litres Brewer 6 uses 1000 litres Brewer 7 uses 450 litres
Violetbank	No brewing in the village	-
Township	3 brewers All brew each week	2 brewers use 300 litres The third uses 100 litres
Itereleng	No brewing in the village	-
Dixie	2 brewers 1 brews each week	Both use 200 litres
MP Stream	9 brewers 2 brewers brew each week	All make 300 litres
Mabharule	4 brewers: 2 of them brew twice/month 2 of them brew once/month	All use 200 litres
Tsakane	4 brewers: 3 of them brew once/week 1of them brew twice/week	Brewer 1 uses 150 litres Brewer 2 uses 100 litres Brewer 3 uses 100 litres Brewer 4 uses 200 litres

Commercial brewers brewed at least once a month through the year, although it was often on a weekly basis. The amount of water used varied from brewer to brewer and was determined by the capacity vessel used for brewing , which varied from 20 to 200 litres, but was on average commonly 200 litres. The total amount per brewer varied from 100 litres (Tsakane) to 1000 litres (Kildare B).

Table 4.11 indicates the number of brewers in each village, the total amount of water/day used for brewing and the average number of litres used per brewer . It can be observed that the total amount of brewers in both groups is similar (22 and 21 in “best case” and “worst case villages” respectively). Also, density of brewers[2] is similar in both types of villages, even though is marginally higher in “worst case” villages. For the “best case” villages there is 1 brewer for every 317 people or 51 households (assuming an average household size of 6.2), whereas for “worst case” villages the proportion is 1 brewer per 274 people or 44 households (assuming an average households size of 6.1).

The differences between “best” and “worst” villages are clearly shown in the amount of water used. . The total number of litres per day is 72% higher in “best case” as a whole (625.8 versus 364.2). At the level of the individual brewer, those in “best case” villages use an average of 28.4 l/brewer/day, whereas for those in “worst villages” daily water consumption is only 17.3 l/brewer/day.

Table 4.11
Water used for brewing.
Total daily use (litres/day) and average use per brewer in each village (l/c/d)

“Best case scenario” villages				**“Worst case scenario” villages**			
Village	**N. of brewers**	**Total l/day**	**Average per brewer (l/c/d)**	**Average per brewer (l/c/d)**	**Total l/day**	**N. of brewers**	**Village**
Shortline	0	0	0	0	0	0	Violetbank F
Dingleydale	4	35.7	9.4	33.3	100	3	Township
Boshoek & Matefeni	1	25	25	0	0	0	Itereleng
Utha	3	71.4	23.8	14.3	28.6	2	Dixie
Xanthia A	7	200	28.6	9.5	85.7	9	MP Stream C
Kildare B	7	293.7	41.9	10.7	42.8	4	Mabharule
				26.8	107.1	4	Tsakane
Total	22	625.8			364.2	21	**Total**
Class average			**28.4** m_1	**17.3** m_2			**Class average**

4.5.3.1 Results for all households (brewers and non-brewers)

Table 4.12 shows the total population figures for each village and the average daily use of water for brewing traditional beer when the total daily use is average across all individuals in the village.

Figures in table 4.12, indicate that villagers in “best case” scenario villages use nearly twice the amount of water for brewing (0.09 l/c/d) that villagers in “worst case” scenario villages (0.05l/c/d). These differences should be viewed cautiously since there is a high variability that is not solely due to the differences in domestic water supply.

[2] Density of brewers was calculated using the total population figures shown in table 4.12 (6986 for “best cases” and 5961 for “worst cases”, counting only villages with brewers).

Table 4.12
Water consumption for beer brewing for all people in all households (brewers and non-brewers) (l/c/d)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**Population figures**	**Average L/c/d for brewing**	**Average L/c/d for brewing**	**Population figures**	**Village**
Shortline	165	0.00	0.00	1800	Violetbank F
Dingleydale	1759	0.02	0.06	1765	Township
Boshoek & Matefeni	1225	0.02	0.00	119	Itereleng
Utha	1250	0.06	0.07	430	Dixie
Xanthia A	1023	0.20	0.06	1594	MP Stream C
Kildare B	1729	0.17	0.02	2007	Mabharule
			0.65	165	Tsakane
Total n_1	7151			7880	**Total n_2**
Class average		**0.09** **m_1**	**0.05** **m_2**		**Class average**

* Note that all class averages (m_1 m_2) are weighted averages (weights calculated as the proportion of the village population size in the total population size for each category)

Even thought, average per capita water consumption is higher in "best case" villages, there are some pairs where "worst case" villages show higher consumption that their pair (Utha - Dixie and Dingleydale B -Township). Also in Tsakane, a "worst case" village, water consumption for brewing is higher than the average for all "best cases" by an order of magnitude (0.65 l/c/d versus 0.09 l/c/d).

These apparent inconsistencies were one of the main limitations encountered when relating the production of traditional beer with different domestic water supply situations. Although access to domestic water is an important factor in determining the ability to engage in the business of brewing beer, there are other locally specific factors that influence this decision. These factors can be at times more important than availability of domestic water in determining the extent of brewing . For example, Tsakane, a traditional beer brewing area and classified as a 'worst scenario' village has a higher consumption than the rest. This clearly indicates that an extra effort in water collection was considered worthwhile by the brewers.

4.5.4 Conclusions

Access to domestic water supply is not the only factor that influences the decision to engage in brewing traditional beer for an income. However, if all the other factors variables are held constant, people in "best case villages" show a tendency to use a higher amount of water to brew traditional beer than those in "worst case" villages.

Also on average, people in "best case" villages (brewers and non-brewers all included) use a higher amount of water per capita per day for brewing traditional beer (0.09) than villagers in "worst case scenario" villages. However, these figures also hide some variations between villages than can be ascribed to factors other than domestic water supply.

4.6 WATER FOR HAIR SALONS (HAIRDRESSERS)

4.6.1 General comments

This activity refers to the informal hairdressing occurring in most villages in the area. Hair salons tend to be small informal businesses that do not have any specific infrastructure allocated exclusively to that use. The business is run in any available room in the homestead (kitchen, living room, and bedroom) or in the backyard. In most villages the business was run by young women who alternated this activity with other household chores or after school hours. In all cases people indicated that the business was run on clients request and therefore, they did not have any particular premises or trading hours for the business.

4.6.2 Approach used to calculate water consumption for hair salons

The following process was used to calculate the amount of water used for hair salons:

1. All hair salon owners were interviewed in each village.
2. The average number of clients per week and the amount of water used per client were obtained from the interview.
3. Total consumption per day for all hair salons, and average consumption/day for each salon was then estimated for each village.
4. Finally, the total amount consumed in the village was average across all individuals in the village (with an without hair salons), in order to get an average consumption per capita/day for the activity in each village.

4.6.3 Results and conclusions

Table 4.13 summarises fieldwork results and indicates the average consumption per hair salon, and the average consumption across all people in the village (with and without hair salons).

Table 4.13
Water consumption for hair salons. Water consumption for those with salons, and consumption for all people in the village (with and without salon)
(L/c/d)

Village	N of hair dressers	Average clients/week	Average litres/client	Total litres/week	Average l/c/d for each salon	Average l/c/d for all people
Utha	3	15	10	450	21.4	0.05
Xanthia A	1	5	10	50	7.1	0.01
Kildare B	1	-	-	-	-	-
Violetbank F	1	25	5	125	17.8	0.01
Township	4	11	10	440	15.7	0.03
Dixie	1	-	-	-	-	-
MP Stream C	1	17	10	170	24.3	0.02

The results shown in this table indicate that:

- For those households involve in hair dressing , daily water consumption varies from 7 l/c/d (Xanthia A), to 24.3 l/c/d (MP Stream C)
- For all households , consumption ranges from 0.01 l/c/d in Xanthia A and Kildare B, to 0.05 l/c/d in Utah.
- Not all villages had hair salons. Furthermore, we did not encounter any differences between “best case” and “worst case” case scenario villages.
- Therefore, although hair salons are run with domestic water, the water situation in the village does not seem to have an influence in either the number of salons or the amount of water used by them.

4.7 WATER FOR ICE-BLOCK MAKING

4.7.1 General comments

In villages where electricity is available, production of flavoured ice cubes locally know as 'ice-blocks' is one of the activities undertaken with domestic water. Ice-blocks are made out of water, sugar and food colouring, and are sold around local schools and markets in small plastic bags. Ice-blocks are only produced during the summer months (October to March). Although many households produced small quantities of ice-blocks for their own consumption, water consumption was only considered for those households had the activity as a regular business..

4.7.2 Water consumption for ice-blocks

The following process was followed in the calculation of domestic water used for ice-blocks

1. The percentage of households in the sample of villages that manufactured ice-blocks was calculated.
2. An analysis the production patterns.
3. An average consumption figure was calculated for those manufacturing ice-blocks.
4. Finally, consumption figures were averaged across all households in the sample in order to arrive at average daily consumption figures for all individuals regardless of whether they were involved in the activity or not.

4.7.3 Data analysis and results

4.7.3.1 Results for households manufacturing ice-blocks

Table 4.14 shows the percentage of sampled households involved in manufacturing ice-blocks in each village, and the average amount of water consumed. The results show that the proportion of households involved manufacturing ice-blocks seems to be double in "best case" villages (13%) compared to "worst case scenario" villages (6%). However, the amount of water used by ice-block business in "worst case" villages (1.03 l/c/d) is twice the amount used in "best case" villages (0.48 l/c/d). This is unexpected and implies that ice-block makers use more water (and therefore make more ice-blocks) in villages where access to domestic supply is worst. Some reasons to explain this apparent contradiction are the following:

- Mean consumption for worst case villages was based on a low number of observations (8) which may have resulted in a biased mean

- The most likely explanation is that, although availability of water is essential, other factors such as access to electricity and fridge are more likely to determine it's likelihood. The two categories of villages considered in the research ("best case" and "worst case") are not homogeneous in terms of these variables and therefore differences shown in table 4.14 are distorted by their effect on the ability of households to be involved in the activity.

4.7.3.2 Results for all households (with and without ice-block businesses)

Table 4.15 presents average consumption figures for the manufacture of ice-blocks for all households, whether they are involved in the business or not, and it is the same in both types of villages (0.06 l/c/d). This result confirms the same conclusions obtained in the previous section.

Table 4.14
Ice-block manufacture, and average water consumption in these households (litres/capita/day)

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH make blocks**	**n_{12}**	**Average l/c/d**	**Average l/c/d**	**n_{22}**	**% HH make blocks**	**n_{21}**	**Village**
Shortline	18	17%	3	0.49	0.00	-	0%	28	Violetbank F
Dingleydale	25	4%	1	0.19	1.03	5	13%	38	Township
Boshoek & Matefeni	40	12%	5	0.50	1.69	2	12%	16	Itereleng
Utha	15	20%	3	0.24	0.00	-	0%	18	Dixie
Xanthia A	24	12%	3	0.31	-	-	-	-	MP Stream C
Kildare B	28	14%	4	0.76	0.00	-	0%	13	Mabharule
					0.25	1	3%	27	Tsakane
Total n	150		19			8		140	**Total n**
Class average*		**13%** **m_{11}**		**0.48** **m_{12}**	**1.03**		**6%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.7.4 Conclusions

- Manufacture of ice-blocks is one of the businesses that rely on domestic water supply. People involved in this activity consume between 0.01 and 0.22 litres/capita/day on it.
- When consumption is averaged across all households in the village, this activity uses an average of 0.06 litres/capita/day.
- Variables other than the level of domestic supply have a greater impact on the likelihood of manufacturing ice blocks. These are access to electricity and a fridge.
- This was confirmed by the results showing that there was not significant differences between "best case" and "worst case" scenario villages in either the percentage of households involved in the business, or the average number of litres used by them.

Table 4.15
Water for ice-blocks
Average consumption for all members in all households (litres/capita/day)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**n_1**	**Average L/c/d**	**Average L/c/d**	**n_2**	**Village**
Shortline	18	0.08	0	28	Violetbank F
Dingleydale	25	0.01	0.15	38	Township
Boshoek & Matefeni	40	0.06	0.2	16	Itereleng
Utha	15	0.05	0	18	Dixie
Xanthia A	24	0.03	-	-	MP Stream C
Kildare B	28	0.11	0	13	Mabharule
			0.01	27	Tsakane
Total n_1	150			140	**Total n_2**
Class average		**0.06** **m_1**	**0.06** **m_2**		**Class average**

* Note that all class averages (m_1 and m_2) are weighted averages (weights calculated as the proportion of village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.8 LIVESTOCK (Cattle and goats)

4.8.1 General considerations

Livestock water consumption is mostly catered for from sources such as cattle dams, rivers and springs, and only occasionally domestic water is used for this purpose. However, fieldwork in Utha, Dixie and MP Stream C showed that the relationship between livestock ownership and availability of "domestic water" was more complex than initially assumed.

Livestock plays a crucial role in rural livelihoods in South Africa. Research into the functions of both cattle and goats for households in communal areas of South Africa shows that livestock plays a far greater diversity of functions in communal areas than in typical commercial production systems. Some of the benefits accrue to both owners and non-owners of livestock (Shackleton et al. 1999) and therefore, issues affecting livestock ownership and production are a major concern for households in most rural communities in South Africa.

Householders consistently mentioned livestock as one of the users of domestic water. Livestock was perceived as a competing user for domestic water, particularly in times of water stress. In some villages, failure to provide appropriate facilities for livestock consumption had resulted in problems in the operation and functioning of domestic supply systems. People reported that cattle and goats used communal taps and that resulted in damaged facilities and health hazards. Also people in Utha and Dixie indicated that villagers have at times vandalised reservoirs and storage facilities in order to access water for their livestock in times of stress.

In a "before and after" assessment following the upgrading to RDP standards of Utha's domestic water system, the increase in the numbers of cattle and goats was identified as one of the changes brought about by the project even though it did not include any improved facility for livestock watering. Villagers indicated that perceptions about security of supply in the village had changed as a result of the project, and therefore, they were more willing to increase herd size[3]. It was also indicated that the improved access to domestic water had resulted in increased possibilities to undertake water related economic activities the generated cash (for example garden). As livestock ownership acted as savings for rural households, the increased in herd size was considered by some as the indirect effect of the improved domestic water supply.

4.8.2 Water consumption for livestock

In order to calculate consumption, livestock numbers were obtained in each village using three methods:

1. In some villages, householders were asked to bring their livestock registration cards to the community meeting. Information from each card was then recorded for analysis.
2. In some others, information on livestock numbers was obtained during the household interviewing process. In Kildare, a member of the water committee agreed to do a full census of the animals owned by each household in the village.
3. Also, independent checks were conducted with the census figures provided by the Veterinary Offices of the Department of Agriculture and Land Affairs in its regional offices of Thulamahashe and Bushbuckridge (town).

Total consumption by livestock was calculated using daily water consumption per head of livestock provided by the South African Institute for Agricultural Engineering. (Daily water requirements for cows as 50 litres/head/day and 90 l/h/d for lactating milk cows). A conservative

[3] Although an actual increase in livestock numbers was documented by checking dipping records kept by livestock owners (see appendix 3.2), it is not clear that the increase in numbers was attributable to the water project. People in the area were rebuilding their livestock numbers after a drought period in 1992 that had dramatically reduced them. It can be argued that the increase would have happened anyway, as it also did happen during the same period in other parts of Bushbuckridge that did not experimented improvements in their water supply.

estimate of 50 l/h/d was used in our calculations. For goats, daily water consumption per goat was estimated to be 5 l/h/d.

Consumption figures were then obtained for cattle owners and goat owners in each village. Also consumption figures for cattle and goat consumption were calculated for all households (owners and non-owners) in each village.

4.8.3 Data analysis and results for cattle

4.8.3.1 Results for cattle owners

Table 4.16 presents figures on the percentage of households that own cows and the average number of cows per owning household . Looking at these results the following can be noted:

- The percentage of households owning cattle varies from 11% to 32% in "best case" villages, and from 0% to 37% of the households in "worst case" villages. The average percentage is the same for both categories of villages (22%). This average compares well with other figures available for the area. Shackleton et al. 1999, examined unpublished results on livestock ownership from a study on household energy-use patterns conducted by Griffin et al. in 1992. The data from that study indicated that 24% of households in Bushbuckridge owned cattle, a similar figure to the results in from our sample. Also, our result is consistent with the general trend for cattle ownership in the Mhala region (one of the two magisterial districts in Bushbuckridge) presented in Shackleton's report (ibid.). Following the 1992/3 drought there was a 10% drop in the number of owners, but the tendency started reversing in 1995/6 with the number owners growing back to 1992 levels.

Table 4.16
Percentage of households that own cattle and average number of cows per owing household

"Best case scenario" villages					"Worst case scenario" villages				
Village	**n_{11}**	**% HH with cattle**	**n_{12}**	**Average number of cows**	**Average number of cows**	**n_{22}**	**% HH with cattle**	**n_{21}**	**Village**
Shortline	18	11%	2	3.5	0	0	0%	28	Violetbank F
Dingleydale	24	29%	7	9.3	6.25	4	11%	36	Township
Boshoek & Matefeni	39	23%	9	8	8	1	6%	16	Itereleng
Utha	201	21%	43	8.7	5.5	8	33%	24	Dixie
Xanthia A	25	32%	8	7.1	11.2	22	37%	59	MP Stream C
Kildare B	28	17%	5	7.8	13	1	8%	12	Mabharule
					7.9	8	30%	26	Tsakane
Total n	335		74			44		201	**Total n**
Class average*		**22%** **m_{11}**		**8.3** **m_{12}**	**9.1** **m_{22}**		**22%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

- For all the pairs of villages presented in the table 4.16, except for the Utha - Dixie and Xanthia A - MP Stream, the percentage of owning households is higher in the "best case" scenario village than in the "worst case" scenario village. The two pairs of villages that do not follow the general trend are located in areas of Bushbuckridge traditionally considered as cattle farming areas[4]. In the case of Dixie, the government of the former Gazankulu homeland established a cattle scheme to encourage cattle ownership in the area and explains why the

[4] The "betterment policies" of the former homeland system designated areas that were to be used by those households interested in cattle ranching activities.

figure for Dixie (33%) is much higher than that of its "best case" pair Utha (21%). In the case of MP Stream and Xanthia A, the close similarity in the number of cattle owners can be explained by the fact that both villages enjoy access to cattle dams.

- For those households that own cattle, the average number of cattle is 8.3 in "best case" villages and 9.1 for "worst case" villages. These figures are somehow smaller than the ones from Griffin et al. 1992 (quoted in Shackletkon et al. 1999). Average herd size for cattle owning households in that study is 13.9. These difference can be explained that by the trend followed by the mean number cattle per owner in the Mhala area during the last ten years (see Shackleton et al 1999). Following 1992/93 drought there was a 51% drop in the mean number of cattle per owner. It reached its minimum at the end of 1994 (less than 7 heads per owning household) and by 1996/7 (the time of our research) it had recovered to 9 cows per owning household.

- A further characteristic for the average number of cattle per household is that it is skewed by a few owners with large numbers of cattle. This is very acute in villages such as Mabharule where the only cattle owning household in the sample had 13 heads of cattle. Appendix 5.1 summarises the main statistic and gives an idea of the variation around the mean in the total data set and the two subsets of "best case" and "worst case" scenario villages.

- There is no significant differences between "best case" and "worst case" villages in either the proportion of cattle owning households or the average herd size . Therefore, under normal conditions (no drought situation), the numbers of cattle in a village, is unlikely to be influenced by access to domestic supply[5].

4.8.3.2 Results for all households (cattle owners and non-owners)

Table 4.17
Average number of cows and average water consumption for all individuals and households (owners and non-owners) (l/c/d)

"Best case scenario" villages				"Worst case scenario" villages			
Village	**n_{11}**	**Average number of cows**	**Average L/c/d**	**Average L/c/d**	**Average number of cows**	**n_{21}**	**Village**
Shortline	18	0.4	4.3	0	0	28	Violetbank F
Dingleydale	24	2.7	24.5	6.2	0.7	36	Township
Boshoek & Matefeni	39	1.8	12.7	4.2	0.5	16	Itereleng
Utha	201	1.9	9.7	17.3	1.8	24	Dixie
Xanthia A	25	2.3	18.2	27.3	4.1	59	MP Stream C
Kildare B	28	1.4	11.7	7.4	1.1	12	Mabharule
				20.7	2.4	26	Tsakane
Total n	335					201	**Total n**
Class average*		**1.8** **m_{11}**	**14.5** **m_{12}**	**16.4** **m_{22}**	**2** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

Table 4.17 presents the average numbers of cattle and average water consumption for all households in the sample (owners and non-owners). An average households in "best case"

---

[5] Factors other than the access to water also influence the decision to buy cattle. Amongst others locality, income level and household life cycle (with younger households less likely to own cattle).

villages (6.2 members) has an average of 1.8 heads of cattle and consumes the equivalent of 14.5 l/c/d . In “worst case” scenario villages the average households (6.1 members) tend to have 2 heads of cattle and consumes the equivalent of 16.4 l/c/d

As in the previous section, the data does not show any relationship between the level of access to domestic water supply and the average number of cattle or the average number of litres used for cattle.

4.8.4 Data analysis and results for goats

4.8.4.1 Results for goat owners

Table 4.18 indicated the percentage of households in the sample that owned goats, and the average number of goats per owning household. Results indicate that:

- 20% of households have goats in “best case” villages, with each having an average of 8.6 goats. In “bad case ” villages the 30% of households own goats with each owning and average of 8.1 goats. These figures indicate a smaller percentage of owners but a larger herd that the figures in Shackleton et al. 1999 (34% owning households and 6.3 average heard size)

- As in the case of the cows, figures do not show any significant differences between “best case” and “worst case” villages for neither the percentage of owning households nor the average number of goats per owning household. This reinforces a hypothesis that percentage ownership and number of goats is not directly dependent on the level of access to domestic water supply.

Table 4.18
Households that own goats

“Best case scenario” villages					“Worst case scenario” villages				
Village	**n_{11}**	**% HH with goats**	**n_{12}**	**Average number of goats**	**Average number of goats**	**n_{22}**	**% HH with goats**	**n_{21}**	**Village**
Shortline	18	17%	3	6.7	1.7	4	14%	28	Violetbank F
Dingleydale	25	28%	7	6.6	8.4	7	19%	36	Township
Boshoek & Matefeni	38	8%	3	7.3	5	1	6%	16	Itereleng
Utha	221	19%	42	9.3	10.8	11	48%	27	Dixie
Xanthia A	25	44%	11	9.4	8.7	27	46%	58	MP Stream C
Kildare B	28	14%	4	5.2	-	-	-	-	Mabharule
					5.7	9	33%	27	Tsakane
Total n	335		70			59		200	**Total n**
Class average*		**20%** **m_{11}**		**8.6** **m_{12}**	**8.1** **m_{22}**		**31%** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.8.4.2 Results for all household (goat owners and non-owners)

Table 4.19 presents the average numbers of goats and the average water consumption for all households in the sample (owners and non-owners). The result indicate that:

- Households in “best case” villages have an average of 1.7 goats per households, and consume the equivalent of 1.4 l/c/d. In “worst case” villages households have and average of 2.6 goats per household, and use the equivalent of 2 l/c/d for their goats.

- The average herd size is similar to that in Shackleton et al (ibid.), who estimates that average number of goats for all households (owners and non-owners) is 2.1 goats.

- The figures do not show any relationship between the access to domestic supply and that the average number of goats and/or the amount of water used for them

Table 4.19
Average number of goats and average water consumption for all households (goat owners and non-owners) (l/c/d)

“Best case scenario” villages				“Worst case scenario” villages			
Village	**n_{11}**	**Average number of goats**	**Average L/c/d**	**Average L/c/d**	**Average number of goats**	**n_{21}**	**Village**
Shortline	18	1.1	1.2	0.1	0.2	28	Violetbank F
Dingleydale	25	1.8	1.6	1.4	1.6	36	Township
Boshoek & Matefeni	38	0.6	0.4	1.1	1.3	16	Itereleng
Utha	221	1.8	0.9	5.0	5.2	23	Dixie
Xanthia A	25	4.2	3.3	2.7	4.1	58	MP Stream C
Kildare B	28	0.7	0.6	-	-	-	Mabharule
				1.6	1.9	27	Tsakane
Total n	335					200	**Total n**
Class average*		**1.7** **m_{11}**	**1.4** **m_{12}**	**2** **m_{22}**	**2.6** **m_{21}**		**Class average***

* Note that all class averages (m_{11} m_{12} m_{21} m_{22}) are weighted averages (weights calculated as the proportion of the village sample size in the total sample size for each category)
** Sample sizes (n) used to calculate each class average (m) are numbered concurrently

4.8.5 Conclusions

This research did not gather systematic data on the factors affecting household decisions to invest in livestock, however, villagers indicated that together with location, income level and household life cycle, availability and security of access to water at village level is one of the important factors driving the decision.

However, although access to water in the village is important for this owning livestock, the level of “domestic water” supply, does not have a direct impact on decisions related to livestock. This is confirmed by the absence of significant differences between “best case” and “worst case” scenario villages in all the variables examined in this section (% ownership, livestock numbers and water consumption) for both cows and goats.

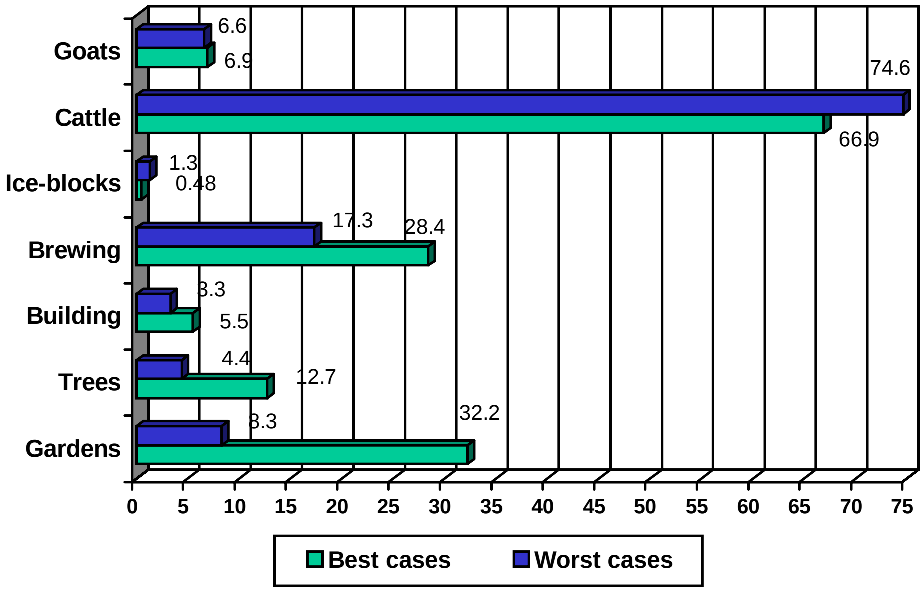
However, there are practical reasons to include livestock in the accounts of domestic water. In order to ensure proper planning and management of village water system, it is important to acknowledge that livestock can become, at times, a priority user of domestic water, particularly in periods of water stress. These situations arise at regular intervals in semi -arid regions such Bushbuckridge (see Pollard et al. 1998).

4.9 OVERALL RESULTS AND CONCLUSIONS

Figure 4.1 shows the average consumption per capita per income generating activity per household. These figures illustrate the amount of water that is currently used for each activity and the difference between "best case" and "worst case" villages. Although not strictly "domestic consumption", figures livestock (cattle and goats) have also been included in the picture.

Detail discussion of each of the activity is provided in the relevant section of this chapter. If livestock consumption is excluded, in all the other activities expect for ice-blocks, water consumption in "best case" villages is higher than in "worst case" villages. The differences range from 67% higher in the case of consumption for building, to 288% higher in the case of water consumption for vegetable gardens.

Figure 4.1
Water consumption per business in households involved in the business (L/c/d)

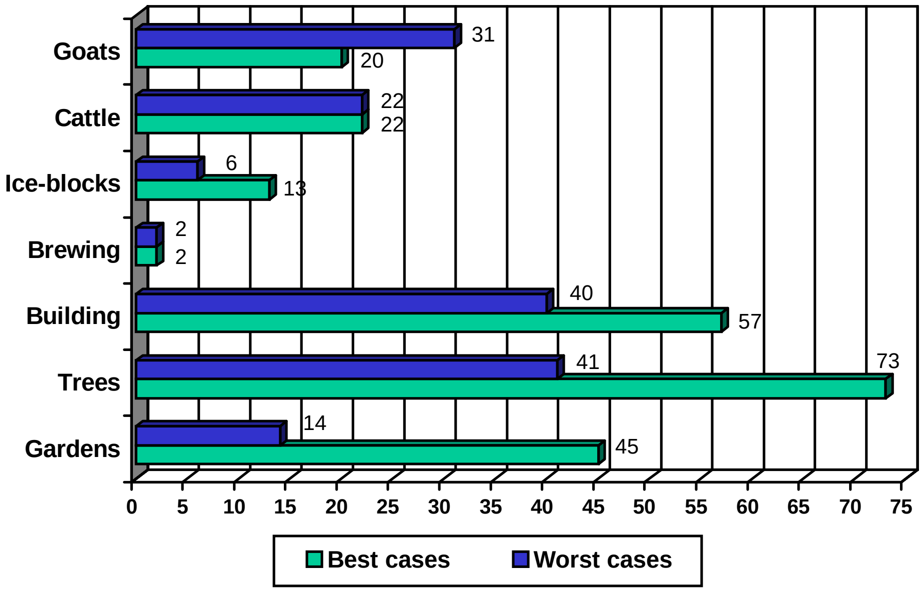


Not all households are engaged in the economic activities presented above. Table 4.2 summarises the rate household involvement per activity in both types of villages. Furthermore, some households engage in various activities at the same time.Excluding rearing livestock , 95% of all households were involved in at least 1 of the remaining 5 businesses, 50% of households were involved in 2 business and 7% involved in 3 businesses.

Comparing between "best case" and "worst cases", households in "best case" villages are more likely to be involved in various businesses that use domestic water, than households in "worst case" villages. The level of involvement in business
the level of involvement in the different businesses was the following:

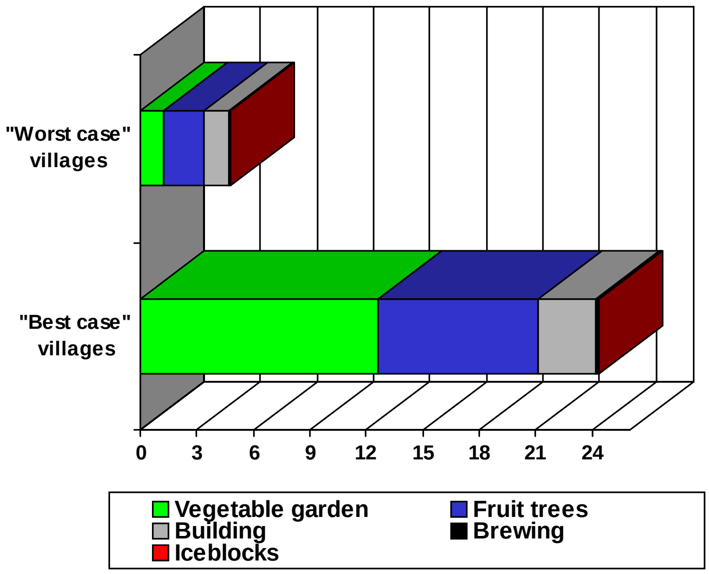
- 98% of all households in "best case" villages and 92% in "worst cases" were involved in at least 1 income generating activity
- 60% of all households in "best case" villages as opposed to 38 % in "worst cases" were involved in 2 businesses. ditto
- 11% of all households in "best case" villages as opposed to 3 % in "worst cases" were involved in 3 businesses. ditto

Figure 4.2
Percentage of households involved in each activity (%)



In order to construct a consumption profile for each type of village, all economic uses of water were divided amongst all individuals in the village, regardless of whether they were engaged in any particular income generating activity. Figure 4.3 summarises consumption figures for all "water-dependent low-level economic activities" for the two categories of villages, and provides a total daily consumption for an average individual in each type of village. Consumption figures for livestock are not included in these calculations.

Figure 4.3
Summary consumption for all "low level economic" activities in "best case" versus "worst case" villages (l/c/d)

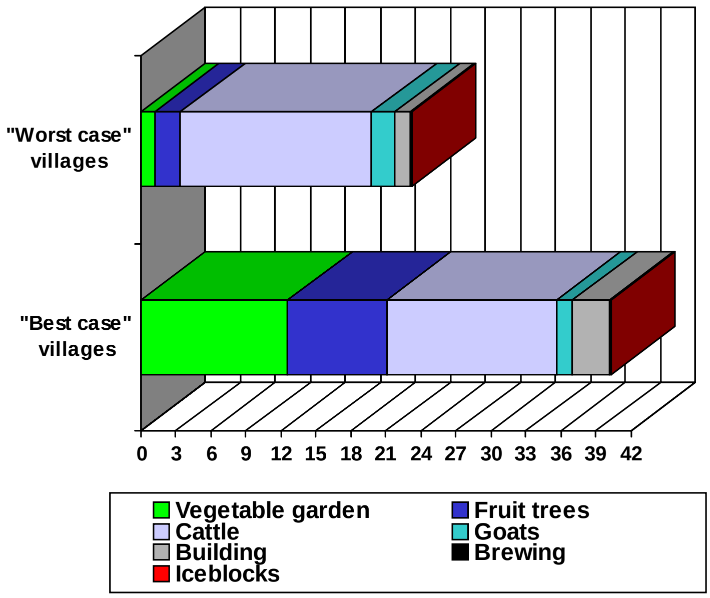


	Best	Worst
	12.6	1.2
	8.5	2.2
	3.1	1.3
	0.09	0.05
	0.06	0.06
	24.4	**5.8**

On average, people in “best case” villages use 24.4 l/c/d of domestic water for “low level economic activities, whereas people in “worst case” village use only 5.8 l/c/d. In other words, people in “best cases” use 4 times more water for productive uses than people in worst case villages. Water consumption for all activities except for ice-blocks, is much higher in best case villages. The differences range from 80% more water consumed for brewing traditional beer, to 950% more water used for vegetable gardens.

If water for livestock is included in the analysis, the total consumption of water for economic activities increases to 40.4 l/c/d in “best case” villages and 23.3 l/c/d in “worst case villages. Figure 4.4 shows the relative consumption per activity in “best” and “worst” cases when the livestock consumption is included. Finally, table 4.20 summarises all consumption per activity for all the villages included in the research.

Figure 4.4
Summary consumption for all “low level economic” activities in “best cases” versus “worst cases” including water for livestock (l/c/d)



Best	Worst
12.6	1.2
8.5	2.2
14.5	16.4
1.4	2
3.1	1.3
0.09	0.05
0.12	0.12
40.4	**23.3**

Table 4.20
Summary of all consumptions for domestic water in all villages
(litres/capita/day)

	SHORTLINE	*VIOLETBANK*	**DINGLEYDALE**	*TOWNSHIP*	**B & M**	*ITERELENG*	**UTHA**	*DIXIE*	**XANTHIA A**	*MP STREAM*	**KILDARE**	*MABHARULE*	*TSAKANE*
Vegetable garden	**14.8**	*2.6*	**4.5**	*0*	**20.3**	*7.5*	**14.4**	*0.1*	**7**	*0.2*	**20.9**	*0*	*0.1*
Fruit trees	**7.2**	*0.6*	**7.9**	*0.3*	**10**	*10.5*		*1.6*	**5.8**		**10.1**	*0.4*	*2.4*
Cattle	**4.3**	*0*	**24.5**	*6.2*	**12.7**	*4.2*	**9.7**	*17.3*	**18.2**	*27.3*	**11.7**	*7.4*	*20.7*
Goats	**1.2**	*0.1*	**1.6**	*1.4*	**0.4**	*1.1*	**0.9**	*5*	**3.3**	*2.7*	**0.6**		*1.6*
Building	**0.7**	*5*	**7.5**	*0.9*	**2.6**	*0.9*	**3.4**	*2.7*	**1.6**	*1.1*	**0.9**	*0.3*	*1.1*
Beer brewing	**0**	*0*	**0.02**	*0.06*	**0.02**	*0*	**0.06**	*0.07*	**0.2**	*0.06*	**0.17**	*0.02*	*0.65*
Hair salons		*0.01*		*0.03*			**0.05**		**0.01**	*0.02*			
Iceblocks	**0.08**	*0*	**0.01**	*0.15*	**0.06**	*0.2*	**0.05**	*0*	**0.03**		**0.11**	*0*	*0.01*
TOTAL BUSINESS	**28.28**	*8.31*	**46.03**	*9.04*	**46.08**	*24.4*	**28.6**	*26.8*	**36.14**	*31.38*	**44.48**	*8.12*	*26.56*
Total without livestock	**22.78**	*8.21*	**19.93**	*1.44*	**32.98**	*19.1*	**18**	*4.47*	**14.64**	*1.38*	**32.18**	*0.72*	*4.26*

*****Note that each villages is presented alongside its pair. Shaded villages are "best case" scenario and the others are "worst case scenario" villages.

CHAPTER 5
RETURNS TO ECONOMIC USES OF DOMESTIC WATER

5.1 INTRODUCTION

5.1.1 General approach used for the calculations

This chapter investigates the economic significance of these differences in water consumption by looking at the income generated from these economic activities. In order to this, the following approach was taken:

1. **Gross margins** (Income minus operating cost)[1] were calculated for each of the water dependent economic activities regardless of whether the goods services produced were marketed or consumed by the household. The value generated in each activity was determined by the mean unit price of the good and service (using local prices), multiplied by the mean rate of production or consumption for that good or service. If a range was given as a reply (e.g. 2-5 times a week, or R5-R10) the mid-point use values was used.

2. **Gross margins per litre of water** were calculated for each activity by dividing the gross margin generated in the activity by the amount of litres used to generate it.

3. Annual water consumed in each activity was then multiplied by the margins per litre in order to obtain annual gross margins from the activity.

[1] Gross margins do not include capital cost

4. Gross margins per activity were calculated for those involved in an income generating activity and for the whole village. The results for each activity were presented in tabular form, and the differences between the two types of villages.

5.1.2 Assumptions and limitations

- The Price of water was not factored into the calculations. Due to the lack of formal systems of payment for water, some people pay high prices and some other do not pay. Also, prices paid show a great variation between villages and between individuals in each village. Chapter 6 discusses the situation regarding prices for water in the area.

- No costs were attributed to own labour within the household, but the cost of labour supplied by others involving cash or in kind transaction was incorporated.

- Establishment costs for the activities were not incorporated into the analysis (gross margins).

- All monetary values are given in 1997 rands. When figures form other studies were used, prices were adjusted using a 12% inflation rate per year.

- It was assumed that all factors influencing the decision to engage in “low level economic activities” were equally advantageous or disadvantageous for all people across communities and therefore, access to domestic water was the main difference between “best and worst cases”.

- Productivity per litre was assumed to be constant across communities and therefore the same gross margin per litre per activity was used in all communities. However, for those activities in which the water is a critical component, improved access to water will raise productivity and therefore, using the same returns per litre may result in an underestimation of the differences between “best” and “worst cases”. This was the case for vegetable gardens and fruit tree production, where margins per litre obtained in “best case” villages were used to calculate total returns in all villages.

- Finally, there are limitations to the use of the gross margins per litre obtained in this research, particularly when using them to calculate returns to water from other sectors (agriculture, forestry, domestic…). Water is not the only input in the production process, and therefore it would be incorrect to assume that all the benefits accrued from the activity are due to water. Also, when comparing different sectors, the relative importance of water in the process varies, and therefore, these comparisons need to be taken with caution.

5.2 VEGETABLE GARDENS

5.2.1 Approach

Chapter 4, section 4.2 provided an overview of the nature of private vegetable gardens. The importance of fresh vegetable production as a source of livelihood varies between households and therefore, even in areas where water availability is not a constraint to production, the amount of time resources allocated and income derived from vegetable production varies across households.

Furthermore, most people found it difficult to provide estimations of total production, as harvesting was carried out throughout the year. Market traders were interviewed to determine the income generated through and indicated that this varied on a monthly basis due to the quantity, variety, access to markets, supply and demand. Estimations of the proportion of the total product that was sold varied from 20% to 50%.

Two sources of information were used to estimate gross margins per litre for vegetable garden activities:

1. In an article that compared the value of wild and domestic plants in home gardens using Dingleydale B as a case study, High and Shackleton 1999, provided an estimation of the mean value of crops grown per household. The value, in 1996, was R676. Gross income per litre of water was calculated using this figure and the information on irrigation practices for Dingleydale presented in chapter 4, table 4.1. The calculations were as follows:

- Average water consumption in households with gardens is 14.8 litres/capita/day
- Average household size for Dingleydale is 5.5 (see chapter 3, table 3.1)
- Total consumption per households per year is : 29711 litres/hh/year
- Assuming an annual inflation rate of 12%, average value of garden production in 1997 was R757.1
- Average value produced per litre is then **R0.025** (757 + 29711)

The use of this return per litre for the calculation of total returns from all villages poses two main problems:

i) The figure for average value provided in High and Shackleton was not a *gross margin* figure because it did not take into account any of the input costs associated with vegetable garden production (cost of seeds and fertiliser)

ii) The figure also included the value of maize and groundnuts produced in the homestead area. These summer crops are normally rainfed and therefore they do not use domestic water for their production. Their inclusion would lead to the overestimation of gross margins.

2. In-depth interviews were held with 4 households of B&M whose source of income included vegetable production. They all had extensive vegetable gardens in their homesteads ranging from $280m^2$ to $675m^2$, and kept adhoc records of total production, cost of inputs and water use. Gross margins varied from R1090 to R4140 and average water use from 2.4 litres/m^2/day to 5.5 litres/ m^2/day. Gross margins per litre were calculated for each garden using the same process described above. The average *gross margin per litre* for all gardens was **R0.013**

The data derived from this last study was selected as it correlated with the definition of gross margins (input costs have been subtracted from the total) and that it was also a more accurate reflection of the returns to domestic water and not any rainfed crops. The following calculations were made using this gross margin per litre figure and the water consumption figures for gardens presented in chapter 4, table 4.1 and 4.2:

- Gross margins/capita/annum for people with vegetable gardens
- Gross margins/capita/annum for all people in the village (with and without gardens)
- Annual gross margins per household for each of the two above. These figures were obtained by multiplying the above results by the average household size for each village provided in chapter 3, table 3.1.

5.2.2 Results and conclusions

Tables 5.1 shows the average *annual gross margins* (per capita and per household) from vegetable production in **households with gardens**. Gross margins per capita in “best case” villages vary from R 70.1 per year in Dingleydale to R413 per year in Kildare B, with an average of R152.5 for all “best case” villages. Gross margins per households vary from R3825.4 in Dingleydale to R2477.3 in Kildare B, with an average of R945.3 for all “best cases”. In “worst case” villages, annual per capita gross margins range from R0 in Township and Dixie to R80.5 in

Itereleng, with an average of R39.3 for all “worst case” villages. Gross margins for the entire household vary from R0 in Township and Mabharule, to R474 in Itereleng, with an average of R239.7 for all villages.

These figures indicate that on average, gross margins from gardens are nearly 4 times higher in “best case” villages than in “worst case” villages (R152.5 versus R39.3 per capita/year, and R945.3 versus R239.7 per household/year). Looking at individual pairs of villages, the differences in gross margins between the “best case” and the “worst case” village in each pair vary from 2 to 1 in the B&M - Itereleng pair, to 13.4 to 1 in the case of Xanthia A - MP Stream C.

These results can be combined with the consumption figures for households with gardens in “best cases” versus “worst cases” shown in chapter 4 (table 4.1). For households with gardens, a 24 l/c/d increase in the average amount of domestic water for vegetable gardens (from 8.3 l/c/d to 32.2 l/c/d), is likely to result in a 290% increase in the gross margins generated from these gardens.

Table 5.1
Vegetable gardens. Annual average gross margins per capita and household (households with gardens) (R/year)

“Best case scenario” villages			“Worst case scenario” villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	157.7	741.1	153.1	31.2	Violetbank F
Dingleydale	70.1	385.4	0.0	0.0	Township
Boshoek & Matefeni	161.0	1143.0	474.9	80.5	Itereleng
Utha	85.2	605.1	54.2	10.4	Dixie
Xanthia A	165.2	1041.1	64.0	12.3	MP Stream C
Kildare B	412.9	2477.3	0.0	0.0	Mabharule
			101.6	17.5	Tsakane
Class average	152.5	945.3	239.7	39.3	**Class average**

Table 5.2 shows *average annual gross margins* generated from vegetable gardens across **all individuals and households in each village, regardless of whether they have garden or not.** Gross margins per capita per year in “best case” villages vary from R21.3 in Dingleydale to R99 in Kildare, with an average of R59.7 for all “best case” village. Gross margins per households from R117.2 in Dingleydale to R682.5 in B&M, with an average of R369.9 for all “best cases”. In “worst case” villages, annual per capita gross margins range from R0 in Township and Mabharule to R35.5 in Itereleng, with an average of R5.7 for all “worst case” villages. For the entire household, annual gross margins range from R0 in Township and Mabharule to R209.5 in Itereleng, with an average of R34.7.3 for all villages.

Therefore, average gross margins are nearly 11 times higher in “best case” villages than in “worst case” villages (R59.7 versus R15.7 per capita/year, and R369.9 versus R34.7 per household/year). Looking at individual pairs of villages, the range of differences in gross margins between “best case” and “worst case” villages vary from 2.7 to 1 in the B&M - Itereleng pair, to 144 to1 in the case of Utha - Dixie.

Combining these results with the consumption figures for gardens in all households in “best cases” versus “worst cases (see chapter 4), it can be concluded that, when all households are considered regardless of whether they have a garden or not, an 11.4 l/c/d increase in the average amount of water for gardens (from 1.2 l/c/d to 12.6 l/c/d) is likely to result in a 950% increase in the gross margins generated from the gardens.

Table 5.2
Vegetable gardens. Annual average gross margins per capita and household (all households) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	70.1	329.4	60.3	12.3	Violetbank F
Dingleydale	21.3	117.2	0.0	0.0	Township
Boshoek & Matefeni	96.1	682.4	209.5	35.5	Itereleng
Utha	68.2	484.1	2.5	0.5	Dixie
Xanthia A	33.1	208.8	4.9	0.9	MP Stream C
Kildare B	99.0	593.8	0.0	0.0	Mabharule
			2.7	0.5	Tsakane
Class average	59.7	369.9	34.7	5.7	**Class average**

5.3 FRUIT TREES

5.3.1 Approach

It was difficult to obtain estimates of either production or income generated from fruit trees. Most households indicated that fruit production is normally harvested throughout the year and it was therefore difficult to estimate total production. Offering fruit as a present to friends and family was common practice, and some households indicated that other members of the community are allowed to harvest their trees for a fee (R50-R200) depending on the number of trees they harvest, the type of fruit and the quality. This was a way of obtaining cash in times of need, but was regarded as second best option as people felt that the value of their fruit was much more than what they normally got.

Data from High and Shackleton 1999 was used to calculate *gross margins per litre* from fruit trees. In their study of the comparative value of wild and domestic plants in Dingleydale, High and Shackleton provide a conservative estimate of the average value of fruit production per household in the village. The average value in 1996 was R392 per household per year, with large variation in value between households. However, these figures are gross values and do not include production cost. Therefore, the main assumption in using these figures is that the input costs for fruit production are negligible. This is a reasonable assumption in the case of fruit produced in the homestead, as the use of fertiliser for trees was only reported in very few cases. Labour is the other main input, and for the purpose of the research is assumed to have 0 cost (see section 5.1.1).

For the purpose of this study, it was decided to use that average figure for the calculation of *gross margins per litre* of domestic water used in fruit trees. The following logic and assumptions were used in the calculation:

1. Fieldwork in Dingleydale had yielded the following information (see chapters 3 and 4):

- Average number of trees for households with trees : 12.3
- Average number of litres used in these households: 10.6 litres/capita/day
- Average household size: 5.5

2. From the above figures, annual use of water per households is: 21280 litres/hh/annum
3. Assuming an annual inflation rate of 12%, average value of fruit production per households in 1997 was R439
4. The *gross margins per litre* of water for fruit trees is **R0.020 per litre** (439 + 1280)
5. Using the derived figure for gross margins per litre and consumption data, the following were determined:

   - Gross margins/capita/annum for households with trees
   - Gross margins/capita/annum per capita the village
   - Annual gross margins per household for the above. These figures were obtained by multiplying the above results by the average household size for each village provided in chapter 3, table 3.1.

5.3.2 Results and conclusions

Tables 5.3 shows the average *annual gross margins* (per capita and per household) from fruit production in **households with fruit trees**. Gross margins per capita in "best case" villages vary from R 74.5 per year in Xanthia A to R114.5 per year in B&M, with an average of R95.6 for all "best case" villages. Gross margins for the entire household vary from R382 in Shortline to R812.7 in B&M, with an average of R593 for all "best cases". In "worst case" villages, annual per capita gross margins range from R15.8 in Township to R76.1 in Itereleng, with an average of R33.1 for all "worst case" villages. For the entire household, annual gross margins vary from R84.9 in Violetbank to R448.7 in Itereleng, with an average of R202.1 for all villages.

These figures indicate that on average, gross margins are nearly 3 times higher in "best case" villages than in "worst case" villages (R95.6 versus R33.1 per capita/year, and R593 versus R201.2 per household/year). Looking at individual pairs of villages, the range of differences in gross margins between "best case" and "worst case" villages in each pair vary from 1.5 to 1 in the B&M - Itereleng pair, to 5 to1 in the case of Dingleydale - Township.

If these results are combined with consumption figures for fruit trees in "best cases" versus "worst cases'" villages (see chapter 4), it can be concluded that, for households with trees, a 7.8 litres/capita/day increase in the average amount of water for fruit trees (from 4.9 l/c/d to 12.7 l/c/d) is likely to result in a 190% increase in the gross margins.

Table 5.4 shows average annual gross margins generated from fruit trees across **all individuals and households in each village.** Gross margins per capita per year in "best case" villages vary from R43.7 in Xanthia A to R76.1 in Kildare, with an average of R64 for all "best case" village. Gross margins per households per year vary from R254.8 in Shortline to R534.7 in B&M, with an average of R396.9 for all "best cases". In "worst case" villages, annual per capita gross margins range from R2.3 in Township to R32.4 in Itereleng, with an average of R10.5 for all "worst case" villages. For households, annual gross margins vary from R12.6 in Township to R191 in Itereleng, with an average of R64.3 for all villages.

Table 5.3
Fruit trees. Annual average gross margins per capita and household (households with trees) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	81.3	382.3	84.9	17.3	Violetbank F
Dingleydale	79.8	439.0	88.6	15.8	Township
Boshoek & Matefeni	114.5	812.7	448.7	76.1	Itereleng
Utha	-	-	129.2	24.8	Dixie
Xanthia A	74.5	469.7	-	-	MP Stream C
Kildare B	112.2	673.2	300.9	40.7	Mabharule
			279.5	48.2	Tsakane
Class average	95.6	593.0	202.1	33.1	**Class average**

These figures indicate that average gross margins are nearly 6 times higher in "best case" villages than in "worst case" villages (R64 versus R10.5 per capita/year, and R397 versus R64 per household/year). Looking at individual pairs of villages, the range of differences in gross margins between "best case" and "worst case" village in each pair vary from 2 to1 in the B&M - Itereleng pair, to 26 to1 in the case of Dingleydale - Township.

Using consumption data provided in table 4.6 it can be concluded that, a 3.6 litres/capita/day increase in the domestic water for fruit trees (from 1.4 l/c/d to 5 l/c/d) is likely to result in a 500% increase in the gross margins.

Table 5.4
Fruit trees. Annual average gross margins per capita and household (all households) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	54.2	254.8	22.1	4.5	Violetbank F
Dingleydale	59.5	327.2	12.6	2.3	Township
Boshoek & Matefeni	75.3	534.7	191.0	32.4	Itereleng
Utha	-	-	62.7	12.0	Dixie
Xanthia A	43.7	275.2	-	-	MP Stream C
Kildare B	76.1	456.4	22.3	3.0	Mabharule
			104.8	18.1	Tsakane
Class average	64.0	396.9	64.3	10.5	**Class average**

5.4. CONSTRUCTION

5.4.1 Approach

Chapter 4, section 4.4 provided an overview of building activities in the Bushbuckridge and the rationale for its inclusion within this study. In order to calculate gross margins for building activities, it was deemed necessary to estimate the net value of housing services to people in the area. However, this was not possible as most people in Bushbuckridge live on communal land. Traditional authorities allocate plots conferring the right to occupy them (RTO), but not private ownership to the land. There is therefore no market for rented properties. When new people move into the area they normally live with friends and relatives until they get a plot allocated in which they can build their house.

Gross margins generated from domestic water used for building were eventually calculated by using the building related market that exists in the area, i.e. the market for cement bricks. Local builders and brick makers indicated that an average of 37 cement bricks are normally obtained per bag of cement. The price of cement and the cost of the sand required per bag were also recorded to obtain a figure for total cost per bag. Finally, the local selling price for cement bricks was used to calculate the income produced per bag. With this information we were able to calculate *gross margins per litre* of water used. The method used for this calculation is summarised in table 5.5.

Table 5.5
Calculation of gross margins to domestic water used for building

Cost per bag of cement	**Income from bag of cement**
➢ Cement : R 20-00 per bag ➢ Sand: R 14-00 per bag	➢ 1 bag cement makes 37 bricks ➢ 1 brick sells at R 1-85
Total cost: R 34-00 per bag	Total income: R 68-45 per bag
Gross margins per bag of cement: R 34-45	
➢ Water used per bag of cement: 125 litres	
Gross margins per litre of water: ***R 0-30***	

The gross margin per litre obtained in table 5.5, together with the consumption figures for building presented in chapter 4 section 4.4.3 were used to calculate the following:

1. Gross margins/capita/annum for people that built
2. Gross margins/capita/annum for all people (regardless of whether they built or not)
3. Annual gross margins per household for each of the two above. These figures were obtained by multiplying the above results by the average household size for each village provided in chapter 3, table 3.1.

5.4.2 Results and conclusions

Tables 5.6 shows the average *annual gross margins* (per capita and per household) from building activities in **households that built**. Gross margins per capita in “best case” villages vary from R 258.9 per year in Shortline to R1155.8 per year in Dingleydale B, with an average of R602.2 for all “best case” villages. Gross margins per households per year vary from R1216.7 in Shortline to R6357.1 in Dingleydale, with an average of R3733.9 for all “best cases”. In “worst case” villages, annual per capita gross margins range from R245.2 in Tsakane to R769.7 in

Violetbank, with an average of R361.3 for all “worst case” villages. For households, annual gross margins vary from R1422 in Tsakane to R3771.7 in Violetbank F, with an average of R2204.2 for all villages.

These figures indicate that on average, gross margins are nearly 1.7 times higher in “best case” villages than in “worst case” villages (R602.2 versus R361.3 per capita/year, and R3733.9 versus R2204.2 per household/year). Looking at individual pairs of villages, the range of differences in gross margins between “best case” and “worst case” villages in each pair vary from 1.1 to 1 in the Utah - Dixie pair, to 3 to1 in the case of Dingleydale - Township. In the Shortline-Violetbank F pair, gross margins in the “worst case” (Violetbank F) are higher than in the “best case” (Shortline). The reasons for this anomaly were explained in chapter 4, section 4.4.

Using consumption data provided in chapter 4 it can be concluded that, for households that built, a 2.2 l/c/d increase in the average amount of domestic water for fruit trees (from 3.3 l/c/d to 5.5 l/c/d), is likely to result in a 70% increase in the gross margins generated from building activities.

Table 5.6
Construction. Annual average gross margins per capita and household (households that built something)
(R/year)

“Best case scenario” villages			**“Worst case scenario” villages**		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	258.9	1216.7	3771.7	769.7	Violetbank F
Dingleydale	1155.4	6357.1	2258.4	403.3	Township
Boshoek & Matefeni	622.3	4418.0	1558.8	264.2	Itereleng
Utha	492.75	2759.4	2288.85	440.16	Dixie
Xanthia A	400.7	2524.6	1586.9	305.2	MP Stream C
Kildare B	240.8	1444.8	1134.4	153.3	Mabharule
			1422.0	245.2	Tsakane
Class average	602.2	3733.9	2204.2	361.3	**Class average**

Table 5.7 shows average annual gross margins (per capita and per households) generated from building (**for** all **individuals and households in each village, regardless of whether they built or not).** Gross margins per capita per year in “best case” villages vary from R76.6 in Shortline to R821.2 in Dingleydale, with an average of R339.4 for all “best case” village. Gross margins per households per year vary from R360.3 in Shortline to R4516.9 in Dingleydale, with an average of R2104.6 for all “best cases”. In “worst case” villages, annual per capita gross margins range from R32.8 in Mabharule to R547.5 in Violetbank F, with an average of R142.3 for all “worst case” villages. In so far as households are concerned, gross margins vary from R243.1 in Mabharule to R2682.7 in Violetbank F, with an average of R868.3 for all villages.

Average gross margins are nearly 2.4 times higher in “best case” villages than in “worst case” villages (R339.4 versus R142.3 per capita/year, and R2104.6 versus R868.3 per household/year). Looking at individual pairs of villages, the differences in gross margins between the “best case” and the “worst case” villages vary from 1.3:1 in the Utha - Dixie pair, to 8.3:1 in the case of Dingleydale - Township.

These results can be combined with the consumption figures for building in all households in "best" and "worst" cases shown in chapter 4 (table 4.8). Then, it can be concluded that, an increase of 1.8 l/c/d for building (from 1.3 l/c/d to 3.1 l/c/d), is likely to result in a 140% increase in the gross margins.

Table 5.7
Construction. Annual average gross margins per capita and households (all households) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	76.6	360.3	2682.7	547.5	Violetbank F
Dingleydale	821.2	4516.9	551.9	98.5	Township
Boshoek & Matefeni	284.7	2021.4	581.4	98.5	Itereleng
Utha	372.3	2084.9	1537.38	295.6	Dixie
Xanthia A	175.2	1103.8	626.3	120.4	MP Stream C
Kildare B	98.5	591.3	243.1	32.8	Mabharule
			698.6	120.4	Tsakane
Class average	339.4	2104.6	868.3	142.3	**Class average**

5.5 TRADITIONAL BEER BREWING

5.5.1 Approach

Chapter 4, section 4.5 provided an overview of beer brewing activities in Bushbuckridge. In order to calculate gross margins for beer brewing in-depth interviews were conducted with beer brewers. Ingredients used for the most common beer (Mqomboti) varied little from brewer to brewer, and therefore gross margins per litre were also similar across brewers. Table 5.8 shows the cost of the ingredients needed to brew a 200 litre drum of beer, and the income obtained. Gross margins obtained from the interviews varied from R0.80 per litre to R1.4 per litre, with an average of R1.05 per litre. This was used as a basis for further calculations.

It must also be noted that a proportion of the water is lost through evaporation during brewing. From the interviews with the brewers it was determined that between 12% to 25% of the water is lost. The mid-point between the two (18.5%) was used to calculate the final amount of beer produced, and therefore, the total income from the activity.

These gross margins, were combined with consumption data from each brewer/brewing system presented in chapter 4, table 4.11 and 4.12, in order to calculate the following:

1. Annual gross margins for an average brewer in each village[2]. This was obtained by multiplying the average amount of beer produced by a brewer in one year by the gross margins per litre of beer. This calculation took into account the fact that only 81.5% of the water use by a brewer turn into beer while the other 18.5% evaporate in the process

[2] An average brewer refers to the average of all the brewers in each village. The same applies to an average hair salon. Whereas in all other business included in the research the number of people involved in the business was estimated from the proportion of households in our sample that were involved in that activity, for the brewing and hair salons we interviewed all such business in the village.

2. Gross margins/capita/annum for all people in the village (brewers and non-brewers).
3. Gross margins/household/annum for all households in the village (brewers and non-brewers). These figures were obtained by multiplying the above results by the average household size for each village provided in chapter 3, table 3.1.

Table 5.8
Calculation of gross margins per litre of domestic water used for beer brewing

Cost per 200 litres of beer	Income from 200 litres of beer
➢ 32.5 kg of maize R 39-00 ➢ Yeast (Mvubelo) R 32-00 ➢ 12.5 kg sugar R 45-00	➢ 1 litre of beer is sold for R 2-00 ➢ They make 163 litres of beer from 200 litres of water
Total costs: R 116-00	Total income: R 326-00
Gross margins per 200 litres of beer: R 210-00	
Gross margins per litre of water: R 1-05	

5.5.2 Results and conclusions

Table 5.9 shows the **gross margins per year for an average brewer** in each of the villages. Annual gross margins per brewer in "best case" villages range from R2567 in Dingleydale to R13083 in Kildare, with an average of R7954 for all villages. In "worst case" villages the annual gross income ranges from R2967 in MP Stream C to R10368 in Township. The average for all "worst cases" is R5825.

Gross income per brewer is higher in the "best case" village in all pair except for the Dingleydale Township. The differences in gross margins vary from 1.8 to 1 in the Utha **-** Dixie, to 3.9 to 1 in Kildare B **-** Mabharule. For all "best case" to "worst case" the difference in annual gross margins is of 1.4 to 1.

Table 5.9
Gross margins per year for an average brewer in each village
(R/year)

"Best case scenario" villages		"Worst case scenario" villages	
Village	**R/brewer/year**	**R/brewer/year**	**Village**
Shortline	0.0	0.0	Violetbank F
Dingleydale	2567	10368	Township
Boshoek & Matefeni	7787	0.0	Itereleng
Utha	7431	4108	Dixie
Xanthia A	8900	2967	MP Stream C
Kildare B	13083	3337	Mabharule
		8344	Tsakane
Class average	7954	5825	**Class average**

Table 5.10 shows the average annual gross margins generated from brewing across **all individuals and households in each village, brewers and non-brewers.** Gross margins per capita per year in "best case" villages vary from R7.7 in Dingleydale to R76.7 in Tsakane, with an average of R34.5 for all "best case" village. Gross margins per households per year vary from R42.3 in Dingleydale to R482.9 in Xanthia A, with an average of R213.9 for all "best cases". In "worst case" villages, annual per capita gross margins range from R7.7 in Mabharule to R249.1 in

Tsakane, with an average of R19.2 for all "worst case" villages. For households, annual gross margins vary from R56.7 in Mabharule to R1444.9 in Tsakane, with an average of R868.3 for all villages.

Average gross margins are 1.8 times higher in "best case" villages than in "worst case" villages (R34.5 versus R19.2 per capita/year, and R213.9 versus R116.9 per household/year). Looking at individual pairs of villages, the range of differences in gross margins between the "best case" and the "worst case" villages vary from 3.3 to 1 in the Xanthia A **-** MP Stream C pair, to 8.5 to 1 in the case of Kildare B **-** Mabharule. The anomalous result for Dingleydale **-** Township pair and t were explained in chapter 4, section 4.5.3 looking at water consumption patterns for brewing.

If these results are combined with the consumption figures for brewing in all "best cases" and "worst cases" (table 4.12), it can be concluded that, when all households are considered (brewers and non-brewers), a 0.04 l/c/d increase in the average amount of water brewing from (0.04 l/c/d to 0.09 l/c/d), is likely to result in a 80% increase in the gross margins generated from beer brewing businesses.

Table 5.10
Brewing. Annual average gross margins per capita and household) (for all households) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	0.0	0.0	0.0	0.0	Violetbank F
Dingleydale	7.7	42.2	128.8	23.0	Township
Boshoek & Matefeni	7.7	54.4	0.0	0.0	Itereleng
Utha	23.0	163.3	139.5	26.8	Dixie
Xanthia A	76.7	482.9	119.6	23.0	MP Stream C
Kildare B	65.2	390.9	56.7	7.7	Mabharule
			1444.9	249.1	Tsakane
Class average	34.5	213.9	116.9	19.2	**Class average**

5.6 HAIR SALONS

5.6.1 Approach

Chapter 4, section 4.6 provided an overview of hair salons. In order to calculate gross margins for this activity, in-depth interviews were conducted with hairdressers in all villages. Cost of ingredients, prices charged and number of clients were obtained for each of the hairdressers. Ingredients used varied depending on the type of service wanted by the client, but the normally included relaxing gel, Vaseline, shampoo and hair food. Prices varied charged varied from R10 to R15 depending on the hairstyle. An average price of R13 was used for the calculation of gross margins. Table 5.11 shows the calculations of gross margins per litre gained from each client.

Table 5.11
Calculation of gross margins per litre of domestic water used for hair salons

Cost per client	**Income per client**
➢ Cost of produce R 4-60	➢ Price: R13-00/client
Total costs: R 4-60	Total income: R 13-00
Gross margins per client: R 8-40	
➢ An average of 10 litres of water are used per client	
Gross margins per litre of water: R 0.84	

These gross margins, were combined with the information on the water consumption by each hair salon (table 4.13), in order to calculate the following:

1. Annual gross margins for a hair salon in each village. This was obtained by multiplying the annual water consumption of a hair salon by the gross margins per litre in table 5.11
2. Gross margins/capita/annum for all people in the village
3. Gross margins/household/annum for all households in the village. These figures were obtained by multiplying the above results by the average household size for each village provided in chapter 3, table 3.1.

5.6.2 Results and conclusions

Table 5.12 shows the total **gross margins returns for an average hair salon**. Annual gross margins per salon vary from R2184 in Xanthia A to R7425 in MP Stream C.

Table 5.12
Gross margins per year for the average hair salon[1] in each village

Village	R/hairdresser/year
Utha	6552
Xanthia A	2184
Kildare B	-
Violetbank F	5460
Township	4805
Dixie	-
MP Stream C	7425

As it was indicated in chapter 4, the number of hair salons and the amount of water used did not seem to relate to the domestic water situation of the particular village. The same was also true for gross returns, and no differences were found in gross returns for hair salons between “best cases” and “worst cases” or the annual gross income per capita. This is shown in table 5.13. Per capita annual gross margins vary from R3.8 in Xanthia A and Violetbank F, to R19 in Utha. If we look at the household, annual gross margins vary from 18.6 in Violetbak F to R186 in Utha.

It can then be concluded that although domestic water is a necessary input for hair salons, under current circumstances, an increase in the amount of domestic water available for hair salons is unlikely to produce an overall increase in the gross returns.

Table 5.13
Hair salons. Annual average gross margins per capita and household (all households) (R/year)

Village	R/capita/year	R/hh/year
Utha	19.0	186.0
Xanthia A	3.8	23.9
Kildare B	-	-
Violetbank F	3.8	18.6
Township	11.4	63.8
Dixie	-	-
MP Stream C	7.6	56.9

5.7 ICEBLOCK MAKING

5.7.1 Approach

Chapter 4, section 4.7 provided an overview of the ice-block business. In order to calculate gross margins for this activity, cost of ingredients, and prices charged per ice-block were obtained from those households in the sample who were involved in the activity. The process used to produce ice-block is very similar in most households. Although small variations only happen in the amount of sugar used in the process, the variation in cost is negligible. Table 5.14 shows process used to calculations gross margins per litre of water used for ice-blocks. Quantities and prices shown in the table are the average of those recorded in the interviewing process. A 20-litre bucket was used as a reference to calculate the cost of ingredients and the amount of ice-block produced. People normally produced two different sizes of ice blocks that sell at R0.30 and R0.50. Margins were calculated for both cases. Production of small ice-blocks gives a higher return per litre than the big ones. Although most people produce a combination of big and small ice-blocks and therefore, the real margin per litre lies somewhere between the two, the lowest return was used for the calculations in order to provide a conservative estimate of total returns.

This gross margins (R1-97), was combined with the information on the amount of water used to make ice-blocks presented in chapter 4, table 4.14 and 4.15, in order to calculate the following:

1. Gross margins/capita/annum for people that made ice-blocks
2. Gross margins/capita/annum for all people (regardless of whether they made ice-blocks or not)
3. Annual gross margins per household for each of the two above. These figures were obtained by multiplying the above results by the average household size for each village (Table 3).

Table 5.14
Calculation of gross margins per litre of domestic water used for ice-blocks

Cost per 20 litres of water	Income from 20 litres of water
➢ Colorant R 2-60 ➢ Sugar R 6-00	➢ 20 litres of water make: ▪ 80 big ice-blocks @ 0-50 each ▪ 160 small ice-blocks @ 0-30 each
Total costs: R 8-60	Total income: R 40-00 (big) Total income: R 48-00 (small)
Gross margins per 20 litres water: R 31-40 (big) *Gross margins per 20 litres water: R 39-40 (small)*	
Gross margins per litre of water: R 1-57 (big) *Gross margins per litre of water: R 1-97 (small)*	

5.7.2 Results and conclusions

Tables 5.15 shows the average *annual gross margins* (per capita and per household) from ice-blocks for **households that are involved in the business**. Gross margins per capita in "best case" villages vary from R 111.6 per year in Dingleydale B to R436.6 per year in Kildare B, with an average of R277.3 for all "best case" villages. Gross margins per households per year vary from R614 in Dingleydale B to R2619.6 in Kildare B, with an average of R1719.1 for all "best cases". In "worst case" villages, annual per capita gross margins range from R141.1 in Tsakane to R971.3 in Itereleng, with an average of R590.5 for all "worst case" villages. For households, annual gross margins vary from R818.6 in Tsakane to R5730.5 in Itereleng, with an average of R3602.0 for all villages. In worst case villages (Violetbank F, Mabharule and Dixie) nobody was making ice-blocks.

Table 5.15
Ice blocks. Annual average gross margins per capita and household (households producing ice-blocks)
(R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	278.7	1309.8	0.0	0.0	Violetbank F
Dingleydale	111.6	614.0	3315.5	592.0	Township
Boshoek & Matefeni	288.2	2046.6	5730.5	971.3	Itereleng
Utha	137.8	978.6	0.0	0.0	Dixie
Xanthia A	175.4	1105.8	-	-	MP Stream C
Kildare B	436.6	2619.7	0.0	0.0	Mabharule
			818.6	141.1	Tsakane
Class average	277.3	1719.1	3602.0	590.5	**Class average**

It emerges from these figures that there is no clear pattern of differences in annual gross margins between "best cases" and "worst cases". Average gross margin in "worst cases" is higher than "best cases". In fact, as it was indicated in the discussion of water consumption for ice-blocks (chapter 4, section 4.7), access to electricity and a fridge rather than water, were likely to be the key factors to engage in the activity. This is also confirmed by the results presented in table 5.16.

Table 5.16 present the average annual gross margins from ice-blocks for **all people and households in each village, regardless of whether they were involved in ice-block business or not**. It can be observed that there is no difference in the overall average margins for "best case" and "worst case" villages (R34.4 per capita/year for both). Also, in two of the "worst case" the villages where ice-block making was happening (Township and Itereleng), annual gross margins were higher than in their "best case" pairs (Dingleydale and B&M respectively).

It can then be concluded that although domestic water is a necessary input in the production of ice-blocks, under current circumstances, an increase in the amount of domestic water available for ice-blocks is unlikely to produce an overall increase in the gross returns.

Table 5.16
Ice blocks. Annual average gross margins per capita and household (all households) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	45.84	215.47	0.00	0.00	Violetbank F
Dingleydale	5.73	31.52	481.36	85.96	Township
Boshoek & Matefeni	34.38	244.12	676.20	114.61	Itereleng
Utha	28.65	203.43	0.00	0.00	Dixie
Xanthia A	20.06	126.36	-	-	MP Stream C
Kildare B	126.07	756.43	0.00	0.00	Mabharule
			33.24	5.73	Tsakane
Class average	34.38	213.17	209.74	34.38	**Class average**

5.8 LIVESTOCK

5.8.1 Approach

Data from Shackleton *et al.* 1999 was used to calculate *gross margins per litre* from livestock (cattle and goats). In their study on the direct use values of goods and services attributed to cattle and goats in the Sand River Catchment (Bushbuckridge), Shackleton et al estimated the net value per cow at R497.2 per annum, and the net value per goat at R56.9 per annum (1999 values).

The following process was used to calculate gross margins per litre for cattle and goats:

1. Estimated net values were deflated to 1997 assuming an inflation rate of 12% per annum. Deflated net values were the R396.4 per annum for cattle, and R45.4 per annum for goats.

2. For the calculation of water consumption it was assumed that cows required 50litres/day and that goats required 5 litres/day (section 4.8.1). Therefore, annual water consumption for a cow was 18250 litres/annum, and for a goat 1825 litres/annum.

3. Using these figures above, the gross margin per litre for cows was the **R0.022 per litre** (396.4 + 18250), and the gross margin per litre for goats **R0.025 per litre** (45.4 + 1825).

4. These two figure were then multiplied by the consumption figures for cattle and goats (tables 4.16 to 4.19) in order to calculate the following:
    - Gross margins/capita/annum for people with cows and people with goats
    - Gross margins/capita/annum for all people in the village (livestock owner and non-owners)
    - Annual gross margins per household for all the above. These figures were obtained by multiplying the above results by the average household size for each village, provided in chapter 3, table 3.1.

5.8.2 Results and conclusions for cattle

Table 5.17 shows the average *annual gross margins* (per capita and per household) from cattle for **cattle owners**. Gross margins per capita in "best case" villages vary from R 295.2 per year in Shortline to R670.2 per year in Dingleydale B, with an average of R530.6 for all "best case" villages. Gross margins per households per year vary from R1387.3 in Shortline to R3686.3 in Dingleydale B, with an average of R2389.9 for all "best cases". In "worst case" villages, annual per capita gross margins range from R419.2 in Dixie to R696.3 in Mabharule, with an average of R591.3 for all "worst case" villages. For households, annual gross margins vary from R2180 in Dixie to R5152.8 in Mabharule, with an average of R3607 for all villages.

Table 5.17
Cattle. Annual average gross margins per capita and households (cattle owners) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	295.2	1387.3	0.0	0.0	Violetbank F
Dingleydale	670.2	3686.3	2477.3	442.4	Township
Boshoek & Matefeni	446.6	3171.0	3171.0	537.4	Itereleng
Utha	351.9	2498.4	2180.0	419.2	Dixie
Xanthia A	446.7	2814.2	3078.0	591.9	MP Stream C
Kildare B	515.3	3091.7	5152.8	696.3	Mabharule
			3131.3	539.9	Tsakane
Class average	530.6	3289.9	3607.0	591.3	**Class average**

These figures show no pattern of differences in annual gross margins between "best cases" and "worst cases". Average gross margin in "worst cases" is higher than "best cases". The reasons for this lack of differences were explained in the discussion of water consumption for cattle (section 4.8.3). Although improved access to domestic water may have an indirect in the average herd number (and therefore in gross margins) through perceptions of increase water security in the village, this hypothesis cannot be confirmed with the figures from this research. In fact, the results here do not show any relationship between access to domestic water and gross margins generated from cattle. This is also confirmed by the results presented in table 5.18.

Table 5.18 presents the average **annual gross margins from cattle for all people and households (owners and non-owners)** in each village. It can be observed that the average gross margins for "worst cases" is higher than the "best cases"(R130 versus R114.9), although the difference is small. It can then be concluded that under current circumstances, an increase in the amount of domestic water is unlikely to produce an increase in the gross returns derived from cattle.

Table 5.18
Cattle. Annual average gross margins per capita and household (owners and non-owners) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	34.1	160.2	0.0	0.0	Violetbank F
Dingleydale	194.2	1068.2	275.2	49.1	Township
Boshoek & Matefeni	100.7	714.8	196.4	33.3	Itereleng
Utha	76.9	546.0	713.1	137.1	Dixie
Xanthia A	144.3	909.0	1125.4	216.4	MP Stream C
Kildare B	92.7	556.5	434.1	58.7	Mabharule
			951.8	164.1	Tsakane
Class average	114.9	712.7	793.1	130.0	**Class average**

4.8.3 Results and conclusions for goats

Table 5.19 shows the average ***annual gross margins*** (per capita and per household) from goats **for goat owners**.

Table 4.19
Goats. Annual average gross margins per capita and household (goat owners) (R/year)

"Best case scenario" villages			"Worst case scenario" villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	64.7	304.0	77.1	15.7	Violetbank F
Dingleydale	54.4	299.4	381.1	68.0	Township
Boshoek & Matefeni	46.6	331.2	226.8	38.4	Itereleng
Utha	43.0	305.7	490.0	94.2	Dixie
Xanthia A	67.7	426.5	273.7	52.6	MP Stream C
Kildare B	39.3	235.9	-	-	Mabharule
			258.6	44.6	Tsakane
Class average	62.9	390.2	367.5	60.2	**Class average**

Gross margins per capita in "best case" villages vary from R 39.3 per year in Kildare B to R67.7 per year in Xanthia A, with an average of R62.9 for all "best case" villages. Gross margins per households per year vary from R235.9 in Kildare to R426.5 in Xanthia A, with an average of R390.2 for all "best cases". In "worst case" villages, annual per capita gross margins range from

R15.7 in Violetbank F to R94.2 in Dixie, with an average of R60.2 for all “worst case” villages. For households, annual gross margins vary from R77.1 in Violetbank F to R490 in Dixie, with an average of R367.5 for all villages.

The results do not show any relationship between access to domestic water and gross margins generated from goats. This is also confirmed by the results presented in table 5.20.

Table 5.20 presents the average **annual gross margins from goats for all people and households (owners and non-owners)** in each village. It can be observed that the average gross margins for “worst cases” is higher than the “best cases”(R110.7 versus R78.8), as it was also the case for the gross margins for cattle discussed in the previous section. Therefore, it can then be concluded that under current circumstances, an increase in the amount of domestic water is unlikely to produce an increase in the gross returns derived from goats.

Table 5.20
Goats. Annual average gross margins per capita and household (owners and non-owners) (R/year)

“Best case scenario” villages			“Worst case scenario” villages		
Village	**R/capita/ year**	**R/household/ year**	**R/household/ year**	**R/capita/ year**	**Village**
Shortline	11.0	51.2	4.4	0.9	Violetbank F
Dingleydale	14.5	79.8	71.1	12.7	Township
Boshoek & Matefeni	3.6	25.8	58.9	10.0	Itereleng
Utha	8.2	58.0	235.9	45.4	Dixie
Xanthia A	29.9	188.6	127.4	24.5	MP Stream C
Kildare B	5.4	32.7	-	-	Mabharule
			84.2	14.5	Tsakane
Class average	12.7	78.8	110.7	18.1	**Class average**

10. OVERALL RESULTS AND CONCLUSIONS

Table 5.20 at the end of the chapter summarises all the annual gross margins per capita from each activity in all villages. These margins refer to average for all individuals in each village, and not only those involved in each activity. Therefore, the table provides a profile of the gross margins derived by an average individual in each community from economic activities depending on domestic. Each village is presented in a column of the table alongside its pair, and with all the “best case” villages shadowed in grey.

Figure 5.1 shows the gross margins per litre for all the economic activities considered in the research. Ice-block making provides the highest margin per litre of water used. However, as it was indicated in chapters 4 and 5, significant differences in the use of domestic water or on the margins obtained from these businesses could not be found between “best” and “worst” villages. The same was true for hair salons. Amongst the activities that showed significant differences in water use and margins between the two categories, the highest margins per litre are obtained from beer brewing followed by building, whereas the lowest returns are obtained from gardens and trees, businesses relatively more intensive in water use.

Figure 5.1
Gross margins for " water-dependent low-level economic activities" (R/litre)

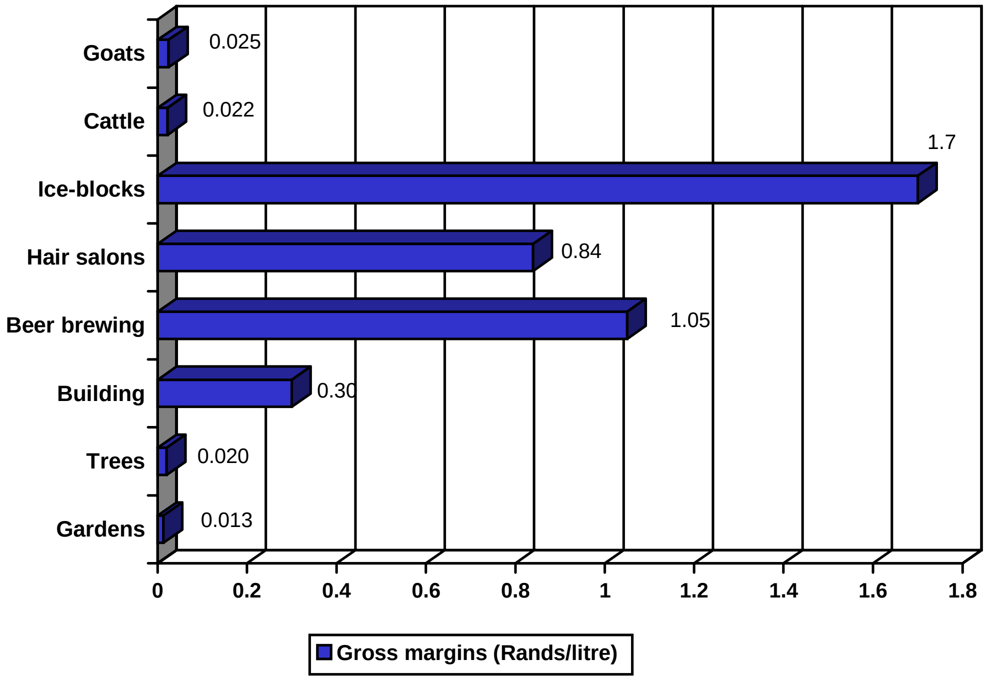


Figure 5.2 shows the annual gross margins per capita obtained by those involved in each business. The highest annual gross margins are obtained from brewing activities in "best case villages and from hair salons in "worst case villages". Gross margins obtained by those in the business were higher for "best case" villages in the same three activities indicated above. For hair salons and ice-blocks, the higher returns in "worst case" villages indicate that, even though domestic water is used for the activity, other factors not considered in the research have a higher impact in the margins obtained from the business (sections 4.6 and 4.7).

For businesses where access to domestic water was a significant factor driving the differences between "best case" and "worst case" villages, beer brewing is the activity with the highest total gross margins per year. An average brewer in a "best case" village obtained R1283 per year whereas an average brewer in "worst case" villages got R923 per year from the business. Building generated the second highest margins, with people that built in "best case" obtaining an average of R602 per capita/year, as opposed to R361 per capita/year in "worst case". For those with vegetable gardens in "best case" villages, annual gross margins were nearly 4 times higher than in "worst case" villages (R152.5 capita/year versus R39.5 capita/year). Finally, people with fruit trees in "best case" villages had annual gross margins nearly 3 times higher than to those in "worst cases" (R95.6 capita/year versus R33.1 capita/year).

Figure 5.2
Annual gross margins per capita for those involved in each activity (R/capita/year)

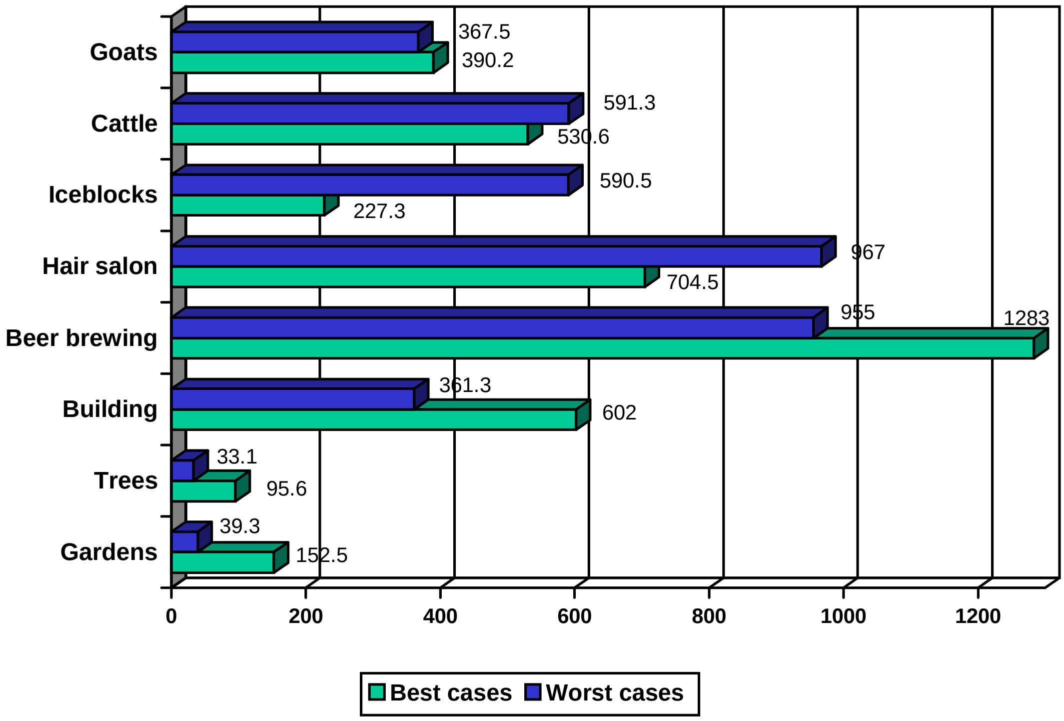
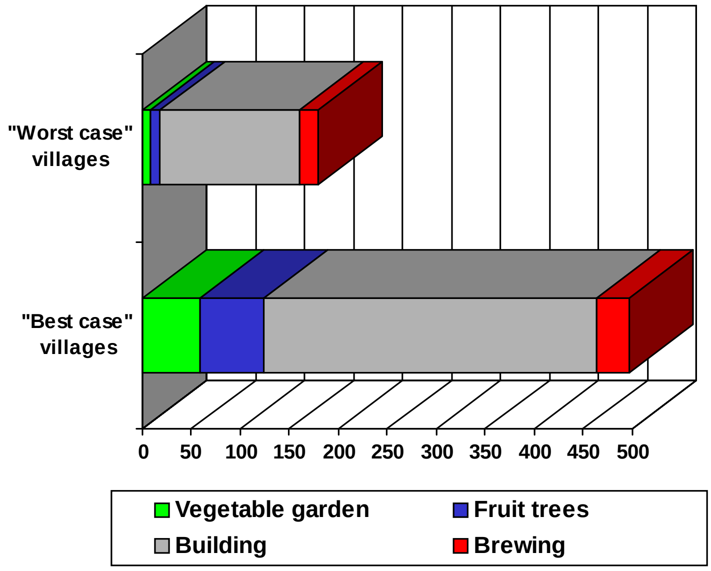


Figure 5.3 shows the total gross margins generated from water related "low- level economic activities" by an average individual in each of the two categories of village. Not all people engage in all activities, and therefore, in order to provide an income profile for each type of village, gross margins for each activity were averaged across all individuals in each category (regardless of whether they were involved in the business or not) and added up. Only those activities for which there were significant differences between categories are showed in the figure (figure 5.4 shows all activities). The results indicates that:

There was a significant difference in the annual gross margins obtained from economic uses of domestic water between people in "best case" and "worst case" villages (R496 capita/year versus R179 capita/year). The higher margins that people 'best case" villages were able to generate from vegetable gardens, fruit trees, beer brewing and building, were a consequence use of their ability to access a higher amount of domestic water for these uses.

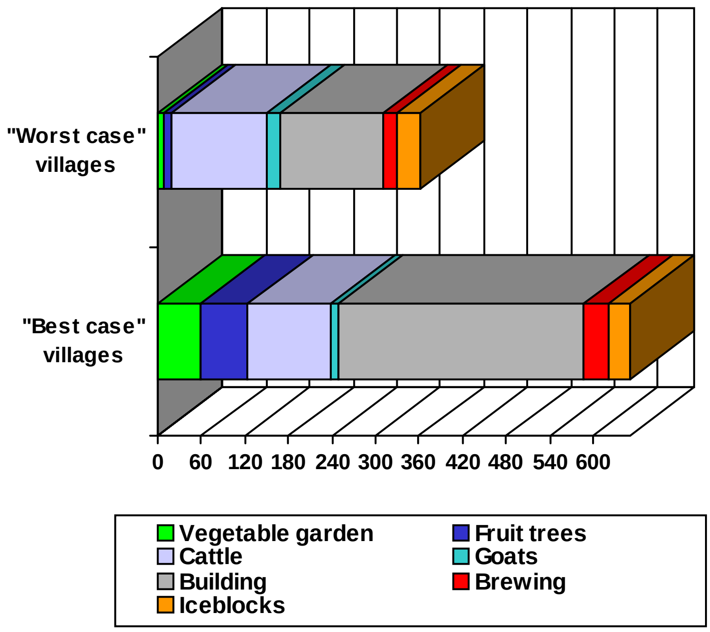
Overall, for these four activities, people in "best villages" used 18.6 l/c/d, or 6789 litres/capita/annum, more than those in "worst villages" (see figure 4.2), and this resulted in an extra income of R317 capita/year for individuals in "best case" villages. I these figures are combined, an average gross margin of R47 per m^3 was generated from the economic use of this extra 7 m^3/capita/annum of domestic water.

Figure 5.3
Total gross margins from “low level economic activties” in the two type of villages (selected activities) R/capita/year)



	Best	Worst
(green)	58	7
(blue)	66	11
(grey)	339	142
(red)	33	18
	496	**179**

Figure 5.4
Total gross margins from “low level economic activities” in the two types of villages (all activitites) (R/capita/year)



	Best	Worst
(green)	58	7
(blue)	66	11
(light blue)	113	131
(teal)	11	18
(grey)	339	142
(red)	33	18
(orange)	33	33
	653	**361**

In order to assess the importance of the income derived from activities using domestic water for people in rural Bushbuckridge, the gross returns were compared to income levels in the area. Income figures for Mhala and Mapulaneng districts were obtained from the 1996 census. They showed that income disparities in the area are very large, with 80% of the people earning no income, 14.4% earning between R1 - R1000 per month, and 4.4% earning between R1000 - R3500. The weighted average for all people was R175.5 capita/month (R2106 capita/year).

Table 5.5 shows the annual gross margins derived from "water-dependent low-level economic activities within the context of the annual income levels for people in Bushbuckridge. Annual gross margins from all activities using domestic water were used in the calculations (those in table 4.4 plus ice-block and hair salons). Gross income derived from livestock was excluded. The figures from this table indicate that:

- In "best case" villages annual gross margins from low level economic activities are the equivalent of 25% of all income earned by an average individuals. In "worst case" villages the percentage decreases to 10% of the average income.
- As most of these activities are part of the "informal sector" of the economy, and some of them do not provide monetary income for the individual, it is unlikely that they accounted for in the estimations of individual income from the census. This may result in under-estimations of income levels for the area that can be as large as 25% of the existing figures.
- Overall, it can be concluded that economic activities undertaken with domestic water play an important part in rural livelihood systems and therefore, the inability to access domestic water for economic purposes can reduce considerably the livelihood options for poor people in rural Bushbuckridge

Figure 5.5
The relative importance of economic uses of domestic water (R/year)

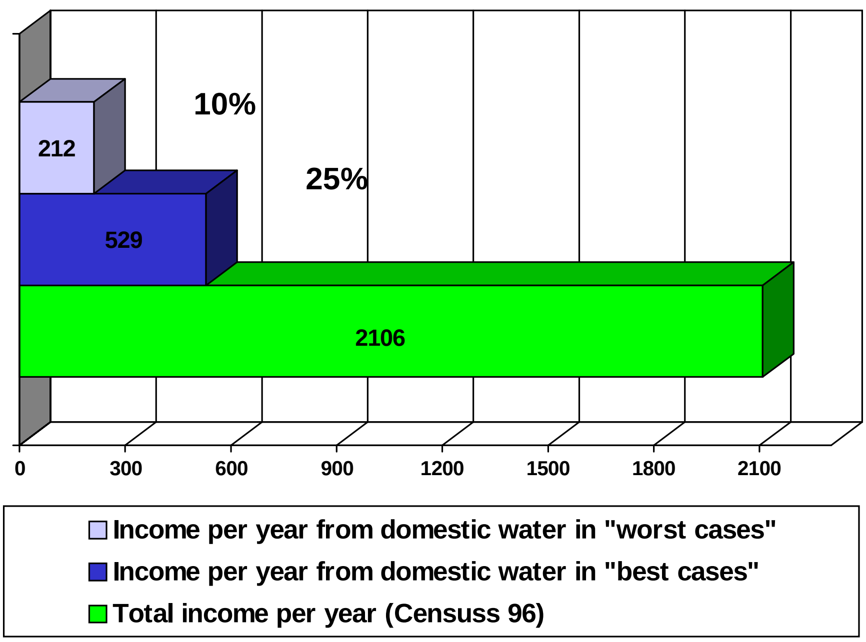


Table 5.21

Annual gross margins for each activity in each village (R/capita/year)

	SHORTLINE	*VIOLETBANK*	DINGLEYDALE	*TOWNSHIP*	B & M	*ITERELENG*	UTHA	*DIXIE*	XANTHIA A	*MP STREAM*	KILDARE	*MABHARULE*	*TSAKANE*
Vegetable garden	**69.4**	*12.4*	**21.9**	*0.0*	**94.9**	*35.4*	**69.4**	*0.4*	**32.9**	*1.1*	**98.6**	*0.0*	*0.4*
Fruit trees	**54.8**	*3.7*	**58.4**	*3.7*	**76.7**	*32.9*	**-**	*11.0*	**43.8**	*-*	**76.7**	*3.7*	*18.3*
Cattle	**32.9**	*0.0*	**193.5**	*47.5*	**102.2**	*32.9*	**76.7**	*138.7*	**146.0**	*215.4*	**91.3**	*58.4*	*164.3*
Goats	**11.0**	*0.0*	**14.6**	*11.0*	**3.7**	*11.0*	**7.3**	*43.8*	**29.2**	*25.6*	**3.7**	*-*	*14.6*
Building	**76.7**	*547.5*	**821.3**	*98.6*	**284.7**	*98.6*	**372.3**	*295.7*	**175.2**	*120.5*	**98.6**	*32.9*	*120.5*
Beer brewing	**0.0**	*0.0*	**7.3**	*21.9*	**7.3**	*0.0*	**21.9**	*25.6*	**76.7**	*21.9*	**65.7**	*7.3*	*248.2*
Hair salons	**-**	*3.7*	**-**	*11.0*	**-**	*-*	**18.3**	*-*	**3.7**	*7.3*	**-**	*-*	*-*
Ice-blocks	**47.5**	*0.0*	**7.3**	*87.6*	**32.9**	*113.2*	**29.2**	*0.0*	**18.3**	*-*	**62.1**	*0.0*	*7.3*
TOTAL BUSINESS	**292.0**	*567.2*	**1124.2**	*281.1*	**602.3**	*323.8*	**595.0**	*515.0*	**525.6**	*391.6*	**496.4**	*102.2*	*573.4*
Total without livestock	**248.2**	*567.2*	**916.2**	*222.7*	**496.4**	*280.0*	**511.0**	*332.5*	**350.4**	*150.7*	**401.5**	*43.8*	*394.6*

*****Note that each villages is presented alongside its pair. Shaded villages are "best case" scenario and the others are "worst case scenario" villages.

CHAPTER 6
PRICES AND PAYMENT FOR WATER IN BUSHBUCKRIDGE

6.1 INTRODUCTION

This chapter reviews the situation regarding payments for water in Bushbuckridge. Researching and understanding the market for domestic water in Bushbuckridge was important for the following reasons:

1. The previous chapters looked at water use patterns in areas with different access to domestic water. If water is considered an economic asset, understanding "effective demand" for water becomes a key element in informing water provision. In this context, it was relevant to look at prices for water and payment patterns in Bushbuckridge.

2. Linked to the previous reason, the extent to which there is an effective demand for water in rural areas is of great interest to policy makers and planners in South Africa. In the context of DRA (see chapter 1), the need to recover the cost of water service provision is now accepted as a priority for the sector (DWAF 1994; DWAF 1997a,b; Jackson 1997; Jackson 1998). The argument is that establishing effective cost-recovery mechanisms is necessary to ensure the sustainability of the water supply systems. It generates a feeling of ownership of the water systems by the community[1] and, most importantly, it is the only way of ensuring the financial

[1] Boydell (1999), referring to evidence from the UNDP-World Bank funded schemes, indicated that, for schemes to be sustainable, communities should pay for O&M and should make a "substantial" contribution to capital costs (this contribution will vary from project to project, but should be substantial enough to generate a feeling of ownership). He also noted that principles of cost-sharing should aim at negotiated cost-sharing arrangements in which the local community chooses the levels of service for which it is willing to pay, based on a full understanding of the implications of that choice (i.e. capital and operational costs are likely to increase for higher levels of service).

sustainability[2] of service providers, and therefore, their ability to continue the service provision into the future.

Although the debate around payment for water is high on the water policy agenda, at implementation level payment for water services is a controversial issue in Bushbuckridge, as in much of the rest of South Africa. A plethora of socio-economic, political and historical dynamics have resulted in a complex reality characterised by a set of related factors and constraints that shape people's experiences and perceptions about payment for domestic water supplies. Some of these factors are:

- In the ex-homeland areas of Mhala and Mapulaneng (Bushbuckridge), a lack of adequate planning resulted in vastly inefficient and unreliable supply systems that left many areas without access to basic water supply and exacerbated differences in access to water between villages and between households in the same village. Formal systems of payment for water were only present in declared township areas and were largely dysfunctional.
- During the political struggle against apartheid, non-payment for services was one of the strategies used to oppose the system. This culture of non-payment has survived the dismantling of apartheid and has turned into a way of showing a discontent with or a reaction against the existing inequalities in access to water
- Poverty, unemployment and a lack of opportunities are particularly acute in the rural areas of former homelands, and therefore, inability to pay for services is an important factor influencing the debate around payment for water.
- In the context of post-apartheid South Africa, the new government is faced with increasing demands on decreasing resources that has resulted in a need to recover costs from services offered. In the case of domestic water supplies, the need of effective mechanisms to implement cost recovery is one of the top priorities on the political agenda in the sector.

Moreover, as controversial as it is, the debate around cost recovery and payment for water is also confused by a series of assumptions around the rural domestic water sector that are too often incorrect and contribute to an incomplete analysis of reality. These are:

- People in rural areas do not pay for water
- Ability to pay for water is the main problem. People are willing to pay but due to the existing levels of poverty, they cannot afford to.

This chapter throws some light on some of these issues using Bushbuckridge as an example. It presents some empirical evidence on payment for water, the prices paid in some villages and it discusses willingness to pay for domestic water in the area.

6.2 PAYMENTS FOR WATER IN BUSHBUCKRIDGE

6.2.1 Formal institutional arrangement for payment for water

There are very few functioning institutional arrangements regarding payments for water in Bushbuckridge. Formal systems of payment exist in some of the declared township of the area (Thulamahashe, Dwarsloop, Mkhuhlu) but these systems do not operate in most cases. The case of Dwarsloop described in section 3.4.2 provides a good example of the situation in most of the townships. Revenue collection systems do not work, unauthorised connections are the norm and most of the existing accounts are in arrears.

[2] Sustainability is defined here as: the benefits of the water-supply project continuing indefinitely in a reliable manner at a level genuinely acceptable to the community it serves and close to the design parameters, without an unacceptable level of external managerial, technical or financial support (DWAF 1997b)

Other existing arrangements for payment of services do occur in rural areas, in projects sponsored by Non Governmental Organisations (NGOs) such as the Mvula Trust and AWARD. These institutional arrangements for payment of services pertain to water supply systems, for specific communities and are normally managed by an ad-hoc community structure (normally a water committee) that oversees money collection and manages the revenue generated. Payments normally take the form of flat tariffs paid monthly by all households in the village. These monthly contributions are used to pay for the operation and maintenance of the system (O&M), and in some cases they are used to contribute towards extensions or improvements to the system.

Table 6.1 summarises the amounts paid per household in villages where AWARD is involved in facilitating a community water supply project. Except for Makgaung, where the system is gravity fed, all the other communities depend on underground water extracted from boreholes with pumps powered by diesel or electricity. Monthly contributions are agreed upon in community meetings. Costing exercises are carried out for the different supply options available, and the amount to be paid is determined by the O&M cost implications for the level of service chosen by the community. The contributions cover the operator cost (in cases where communities hire their own operator), electricity or diesel costs and the remainder is deposited in an account to cover maintenance costs or improvements to the system. How well these arrangements operate vary from village to village, and successes and failures are both encountered across the entire spectrum of projects[3].

Table 6.1
Household contribution to O&M in AWARD village projects

VILLAGE NAME	RANDS PER HH/MONTH
Utha	R 7
Dixie	R 7
Seville A	R 10
Seville C	R 5
Makgaung	R 1

6.2.2 Informal arrangements. The market for domestic water in Bushbuckridge

Formal arrangements for the payment of water are absent from most villages in Bushbuckridge. However, water is frequently paid for through non-formal systems and it is a very expensive commodity for many households in Bushbuckridge. In order to understand the dynamics of the informal water markets, surveys of water vending activities were conducted in each village.

Water-vending is a common business in Bushbuckridge. The profile of water vendors encountered in the area correspond to the following typology:

- People owning private transport, normally a bakkie, who hire out their vehicle for a fee. The quantity of water fetched per trip varies depending on the size of the vehicle. Prices charged for the water vary with distance to the water source and with kinship relationships between vendors and clients (prices are much lower for family and friends).
- People with access to private boreholes. The cost of developing the source (pumps, storage tanks) and the O&M cost are carried by the owner, and people buy directly from him or her. Prices are normally fixed per container of a given size

[3] For a discussion of the factors contributing to the success and failure of some of these schemes see Dreyer 1998. Both the Mvula Trust and AWARD conduct evaluations on their projects and produce reports and publications on the lessons learnt from them. For more information consult their websites at www.award.org.za and www.mvula.co.za

- People who hire out their time to fetch water for others. They are generally children and youngsters who queue at water points and deliver the water at the buyers' site. Price variations are large and depend on the distance to the source, the amount of water fetched, kinship relations, age and sex of the seller, with younger females receiving the lowest payment.

Table 6.2 summarises the main findings on water vending activities. Direct water-vending activities were recorded in 5 "worst case scenario" villages (see table 2.1). Therefore, it is in villages with the worst water supplies that people are paying for water. Some people in "best case scenario" villages also reported buying water, however, they indicated that this only happened sporadically and it was normally linked to celebrations and functions when large quantities of water were required in a very short period of time.

In Township, 94% of the households interviewed indicated that they bought water on a regular basis. In Mabharule, Violetbank F, and MP Stream C, the percentages were 83%, 67% and 80% respectively. From those who bought water regularly, 50% in Mabharule and 73% in Violetbank F did it at least once during the week previous to the interview. In Township, 44% of households buying water did it on a daily basis.

72% of households in Township and 84% in Violetbank bought water for "basic needs". Building was reported as another important reason to buy water, with 25% of households in Mabharule and 50% in Violetbank F buying water for construction. Households also bought water to brew traditional beer. All the traditional beer brewers in Township and 50% of them in Mabharule reported buying the water they used for brewing. Some households also mentioned buying water for vegetable gardens and other water dependent business.

Prices for water show a large variation from village to village and from vendor to vendor within the same village. The range of prices encountered varied from R0.25 for 25 litres recorded in MP Stream C to R2.50 per 25 litres in Mabharule, with prices around R0.20 to R0.50 per 25 litres being the norm in most villages were vending activities were recorded.

In "best case scenario villages" most households obtain water free of charge, this may involve making unauthorised connections to main pipes running through the village[4]. Although in some areas households request permission to connect to the network, in most places connections are not regulated and are performed when the need arises. Households by the materials and contract local plumbers or make the connections themselves. In Xanthia and M&B some households indicated that the cost of making a connection varies from R180 to R400, including material and labour costs when local plumbers are hired.

6.2.3 A comparative analysis of prices paid for water in different locations

Buying water is a daily task for many households in rural communities in Bushbuckridge, particularly in villages with a poor water supply. Prices paid are well in excess of those paid in areas with regularised household connections and un-limited access to water.

[4] For a detailed discussion on the topic of unauthorised connections in the Northern Province and Mpumalanga see: Consultburo*, Afrosearch-Index, and Fundile Africa. 1996.* "Survey of unauthorised connections in water supply schemes in the Northern and Mpumalanga provinces." Department of Water Affairs and Forestry. South Africa.

Table 6.2
Water vending activities

VILLAGE	NUMBER OF HH BUYING WATER	PRICES	WHY DO PEOPLE BUY?
Violetbank F	• 28 households randomly selected from a total of 360 • 67% of households reported buying water on a regular basis, of which: • 73% bought water at least one day during the week prior to the interview. • 84 % bought for basic needs. 50% bought water for building and 32% for food gardens	• R0.50 to R2 for a 25 litres container . • R30 to R50 per trip for hiring a bakkie (average of 500 litres). • Barter arrangement for food and other goods	• Water source is too far • No time to fetch water • Source is very unreliable and have to wait in long queues • Need for large quantities for activities such as building, gardening or functions
Township	• 36 households randomly selected from a total of 314 • Only two hh. reported not having ever bought water. Both had bakkies • 94% of households reported buying water on a regular basis, of which: • 69% bought water at least one day during the week prior to the interview. • 44% buy water everyday • 72% bought for basic needs, 33% for building, 25% bought for other water related businesses • All the traditional beer brewers in the village bought water for brewing	• R0.50 for 25 litre container or R0.30 for 20 litres • Water bought from a privately owned borehole deemed very reliable and closer than the alternative free source • R30 to R100 per trip for hiring bakkie (average of 500 litres). • Barter arrangements	• Free source is too far away • Buy during the week because kids are in school. Over the weekend kids fetch from free source • Traditional source not reliable. Waste time to go there and there is no water • Only buy when money available
Mabhrule	• Group discussion with 12 hh. attending • 2 hh never bought water. One of which had a bakkie • 83% of households reported buying water on a regular basis, of which: • 50% bought water at least one day during the week prior to the interview. • 75% bought for basic, 25% for building and the 2 brewers in the group bought for brewing	• R1 to R2.50 for a 25 litres • R30 to R40 per trip for hiring bakkie (average of 400 litres). • Payments in food or barter for other goods	• Hiring bakkies was the most common way of paying for water • Available village well very unreliable. Long queues. • System by which only 3 containers can be fetched at a time (avoid queues)
MP Stream	• Group discussion with 58 hh. of 207 in the village • 80% reported having bought water in the previous six months • Majority bought for basic, building and brewing	• R0.25 (R1 for 100 litres) to R0.10 per 25 litres • R40 to 50 per bakkie (average 350 litres) • Payment in food	
Dixie	• Group discussion with 25 hh of 76 in the village • Buying water regular for some hh but not widespread	• R 0.10 per 25 litres • R40 to R50 per bakkie	• Problems with salinity of the source

Table 6.3 provides a comparison of prices/ m^3 paid by users in different locations. Prices/ m^3 in Violetbank and Township have been calculated from the prices showed in table 6.2. In the neighbouring town of Hazyview (just outside the Southern border of Bushbuckridge), monthly service charges under normal conditions are R30 plus usage tariffs of R1.40 per m^3. Under water restrictions, prices for water go up to R1.62 per m^3 (USAID,1998). In Dwarsloop and Mkhuhlu, two declared townships within the Bushbuckridge area, monthly service rates amount to R7.00 for residential uses and R10.75 for business. Block-rate usage tariffs are R0.20 per m^3 for the initial 50 m^3, plus R0.30 per m^3 thereafter.

Table 6.3
Comparative consumer prices for water in different locations (R/ m^3)

LOCATIONS			
Violetbank F	**Township**	**Hazyview**	**Dwarsloop Mkhuhlu**
12.00	15.00	1.40	0.50

Therefore, prices per m^3 of water are one order of magnitude higher in rural communities than in declared townships and neighboring towns. Moreover, in both Violetbank F and Township water is not provided on site and people have walk long distances to the source. Therefore, people in poorly serviced rural areas of Bushbuckridge are paying much higher prices for water than urban dwellers. Furthermore, when comparing these prices with those paid in other areas of the country, prices for domestic water in some of the Bushbuckridge villages are well in excess of prices paid in some of the richest households in the country. For instance, in areas such as Greater Hermanus, tariffs consist of a monthly connection fee of R40 per month and a water usage tariff (excluding VAT) starting at the very low level of R0.30 per m^3 for the first 5 m^3 and gradually increase in 10 steps to R10 per m^3.

6.3 REASONS AFFECTING WILLINGNES TO PAY FOR WATER IN BUSHBUCKRIDGE

The previous section presented and analysed the reality of payment for water in Bushbuckridge. However, a different question is whether households are willing to pay for water or not. It is generally argued that in an area with a poor water supply where people are forced to buy water from vendors, once an improved water system is in place, willingness to pay decreases dramatically even if general access to water improves and the price for water from the new system is lower than those paid to the traditional vendors. This has serious implications for water policy, particularly when trying to implement effective cost recovery mechanisms. Therefore, understanding the extent to which people are willing to pay for water, and the factors that affect willingness to pay are crucial tasks for policy makers and water service providers.

“Willingness to pay” studies are nowadays accepted as valid methods of understanding what the clients want before an improvement in a water system is undertaken. However, it was out of the scope of this study to carry out willingness to pay studies in each of the case study villages. Large-scale contingent valuation surveys of households’ willingness to pay are very costly and under normal circumstances can only be justified in the case of villages that are about to have an improvement in their water system. This was not the case in our case study villages. Nevertheless, a great deal about willingness to pay in a particular locality can be learned from a survey of water-vending activities of the type carried out in this research. The assumption is that where water vending is prevalent, demand for improved water services is high (World Bank Water Demand Research Team, 1993).

The extent of water vending activities in the area, analysed in the previous section, would point to a high demand for improvement in the water systems. This is generally true for most villages in Bushbuckridge. However, when asked whether they would be willing to pay for such an improvement people in most villages raised a number of questions that indicated that willingness to pay for water in the area may be generally low. The reasons provided were different in nature, and had to do with cultural, political, institutional and economic factors. This section summarises opinions and perceptions about "willingness to pay" for water raised in discussions and meetings during the fieldwork. Each reason provided is illustrated by literal answers recorded during the discussions.

6.3.1 Cultural reasons

"Why should we pay for the water when it comes from God"

Some people in Bushbuckridge consider water as the source of life ("a gift from God") and do not understand why anybody should pay for it. In villages close to river courses (Dingleydale, M&B) discussions centred around the issue of why water should be paid for if it was already in the river. People agreed to the idea of payments when the source needed to be developed (for example the development of a borehole), or for the operation and maintenance of their own system. However, paying for the water consumed was difficult to understand for most people.

6.3.2 False expectations generated by the government

"Government promised that they would solve the problem of water and that everybody would get for free as much water as they needed"

In several villages people expressed concern about government not fulfilling electoral promises. People claimed that the government had led them to believe that they would provide water for everybody and carry the cost of doing so. For example, in Mabharule, a water system recently installed by DWAF was not functional because the pump had run out of diesel and people were expecting the government to bring the diesel

6.3.3 Confusion regarding new water policies, and the concept of water as a constitutional right

"If government policy says that water is a right why do we have to pay for it". "Should we pay for rights? I do not pay to be alive"

In some communities people expressed their confusion with the contents of the new water policy, particularly with the concept of water being a right. Some people refused to pay because they believe that they had a legal right to receive free water and therefore, any attempt on the part of the water committee to make them pay even for O&M was illegal.

6.3.4 Inadequacy and lack of reliability of the service offered

"I cannot pay for something I do not get"

In some communities people indicated that they would not pay until they get a proper service. The experience of most people in Bushbuckridge is that water services are unreliable, with villages experiencing shortages for weeks. Repairs to the system take too long and the service is not good. They indicate that they will not pay until it is clear that what they get is worth the money they pay for it. Some people appear suspicious of having to pay first to secure a good service.

6.3.5 Problems with the level of service offered

"I will not pay for a communal tap. Bring me a yard tap and then we will talk about payments"

In some communities people expressed their dissatisfaction with the level of service offered to them. Particularly in villages with communal standpipes people expressed their discontent at having to walk to fetch their own water and being expected to pay for it.

6.3.6 Inadequate quality/price relationship for water

"I don't want to pay for drinking quality water to irrigate the vegetable garden"

The issue of multiple uses for domestic water was raised several times. Human consumption was only one of the uses and therefore it was felt that the price of water should not be the same for all uses. Some people indicated that focusing only on drinking water would not solve the water shortages experienced in their communities. In villages with extensive vegetable gardens, owners expressed concerns with the new water policy and confessed the fear that payment for water would make their businesses not viable.

6.3.7 Inequitable access to water

"I hardly get any water and still have to pay the same as somebody closer to the source"

Unequal access to water within the same community is a common problem throughout BBR. It was felt that expecting the same contribution from those close to the reservoir and enjoying better and more reliable supply, as from those who do not get water as easily was not appropriate.

In one section of Kildare problems arose when the pump that supplied the reservoir run out of diesel. Disagreement as to who should contribute to buying diesel started when some people claimed that they did not benefit at all from the pump (water pressure was not enough to reach their yards) and therefore they would not pay to buy the diesel. Two months after the problem arose, the issue remained unsolved and the pump remained idle.

6.3.8 Generalised illegal/unauthorised connections

"People have tampered with the pipes and put their own connections. Water does not reach my place. I cannot be expected to pay for it"

Unauthorised connections are a widespread phenomenon. Villagers reported that in most cases authorities have provided tacit and overt support for this practise, thereby entrenching the perception that this is normal. As indicated in the White Paper on Water Supply and Sanitation Policy (RSA DWAF, 1994) *"…This practice generally results in the failure of the system and those consumers in high lying areas or at the end of the distribution system do not get any water."*

Villagers in Kildare, Dingleydale, B&M, and Itereleng, raised concerns about generalised unauthorised connections and the lack of access to water in some parts of the community. These resulted in internal conflict. It proved impossible to organise a community meeting for the entire village as water issues in the village was very controversial. Most meetings ended with people accusing each other of having too many connections and using too much water. Community structures felt disempowered to tackle the problem and indicated that previous attempts to organise an O&M system for the village had failed due to the same problem.

6.3.9 Lack of regulatory systems to promote and maintain cost-recovery initiatives

"I do not pay because other don't pay and nothing happens to them"

In some of the communities people indicated that they did not pay for water because authorities were not serious about the enforcement of regulations regarding payment for water. In some instances people expressed their lack of trust in the structures that were supposed to collect and administer the funds.

Dwarsloop is one of largest and fastest growing townships in the area. There is a formal system of payment for water and bills are issued from the Town Office. In interviews held with officials from the office, they recognised their lack capacity to enforce regulations. There are also problems with unauthorised connections and meters that are tampered with by residents. In a group discussion, residents indicated that one of the main reasons for not paying was the lack of enforcement on behalf of town authorities, as non-payment held no consequences. They also indicated their lack of trust in the system because of inaccurate readings, and bills not being issued timeously.

6.3.10 Lack of trust in village structures

" I will not pay to a committee in the village. I do not trust them. Let government collect the money"

Community members in Township refused to give initial contributions for a project that would improve village water supply. They indicated that the water committee had previously asked for improvements that never happened. They accused water committee members of pocketing the money and indicated that they wouldn't agree to any financial dealings with that committee. They would rather deal with government officials directly.

6.4 CONCLUSIONS

- That rural inhabitants do not pay for water cannot be assumed in general. Evidence from Bushbuckridge indicates that the opposite may well be the case. Prices paid by rural households are in some instances much higher than prices paid in areas where proper cost-recovery mechanisms are in place.

- The second assumption that needs to be revised is that poor people cannot pay for water. Whereas low affordability is a reality for many rural households, as poverty in the province is concentrated mainly in rural areas, evidence shows that it is likely that the poorest people in the Bushbuckridge area are facing the highest prices for water.

- Nevertheless, the issue of whether poor people can afford to pay for water needs to be separated from that of whether they should pay or not and how much. The two are different questions and the evidence showing that poor people can and do pay for water should not imply that the priority for the sector is to make poor people pay for water.

- Where the need for payment for water is justified, the fact that rural people are paying the highest prices for water indicates that there is room for maneuver and that, in some cases, implementing a formal payment system, with tariffs reflecting local conditions and choice of level of supply, can improve the situation of the poorest (some degree of cross subsidization is possible)

- Reasons why people decide not to pay for water are complex and in many instances can not be attributed to a single cause. Understanding these reasons and perceptions must become a priority for policy makers and water service providers due to the potential effects on cost recovery and ultimately on project sustainability. Failure of water projects is too often attributed to low affordability (ability to pay) when the real reasons are more to do with “low willingness to pay” and others provided in this chapter.

CHAPTER 7
LESSONS, CONCLUSIONS AND POLICY ISSUES

7.1 INTRODUCTION

Chapter 1 provided the policy background and the motivation for this research in the context of South Africa's new water law. The shift towards DRA and sustainability in the WSS sector has underscored the need to better understand demand for domestic water. Yet, current understanding of domestic water demand, especially in rural areas is still poor. This is partly a result of historical legacies as well as a result of an implicit assumption evident within the water sector, namely that the water required by rural people is mainly for domestic purposes, i.e. to meet basic needs. Clearly, the minimum level of 25 l/c/d may be sufficient to meet basic needs but offers little else in terms of additional water for small-scale economic activities, or water for productive use.

The need to better understand demand guided the formulation of the questions of this research (see section 1.2.3). This final chapter provides the main lessons learnt from the evidence gathered in response to these questions, highlights policy of these findings, and identifies further topics for research.

7.2 THE "RESERVE" FOR BASIC HUMAN NEEDS

In a fundamental departure from the previous water act, the new Water Act of 1998 recognises water allocations to two water "users" ***prior to*** provision to any other sector. This is embodied in the concept of "the Reserve", which comprises both water for the river itself (to main ecological integrity) and water for basic human needs (calculated at a minimum of 25 l/p/d).

Current practice in the RWSS sector in South Africa emphases the provision of 25 l/c/d within 200 meters from the household as the minimum standard of supply for all South Africans (RDP standards). This has been the objective of most of the delivery effort undertaken by the government and NGOs involved in the sector since 1994. On of the questions this research was set out to answer was whether, given the current minimum national standards for domestic supply (RDP minimum standards), and current use patterns, this minimum standard met basic needs[1] in the rural areas of Bushbuckridge.

Results from the study area indicate that where the maximum level of service is a yard tap, an average of 19 to 27 l/p/d are consumed for basic domestic needs including human consumption, cooking, cleaning household, washing dishes and washing clothes (see Table 3.3). Therefore, it

[1] For the purpose of this research "Basic Needs" is defined as: Water for drinking, cooking, personal hygiene, household cleaning, washing clothes. See definitions

can be concluded that, **given yard tap connection as the maximum level of supply**, **and current consumption levels**, **basic human needs are covered within the first 25 l/p/d** (see Figure 3.1)

However consumption seems to increase dramatically with higher levels of service, particularly if the household has access to shower/bath and water-borne sewerage systems, and the service is provided at no cost to the consumer. (See Table 3.5 and 3.6). Furthermore, the aforementioned minimum standards do not cover people's aspirations to have access to improved sanitation facilities and other consumptive uses of water (let alone productive uses of water). People living in fully serviced households in the "township" known as Dwarsloop (see Appendix 3.3), reported a high use of domestic water for watering lawns and gardens, and washing cars. Therefore, the sustainability of domestic water systems will continue to be dependent not only on their ability to meet the basic needs but also on their flexibility to provide differential levels of service for different people.

From a policy perspective it can be then concluded that, for the Bushbuckridge area, there is enough evidence to inform the allocation of water for the 'Reserve' using the figure of 25 l/p/d as the minimum amount required to meet basic human needs. The main challenge now remains as to how to make this concept operational. Research need to be put into the design and implementation of allocation mechanisms to make the concept of the 'Reserve' operative. These allocation mechanisms will need to be appropriate from the technical, institutional and economic perspective so as to ensure sustainable access to domestic water both for present and future generations.

7.3 WATER FOR PRODUCTIVE USES

One of the intended outputs of this research has been to "make visible" an economic sector whose very existence has been neglected mainly, but not only, in terms water allocations. As it has been shown in this report, domestic water in Bushbuckridge is used for a combination of *consumptive* (basic needs) and *productive* purposes. The term "water-based low-level economic activities" has been used to refer to this heterogeneous sector. It includes a host of activities that are highly dependent on the availability of secure and reliable water supplies. Vegetable gardens, cattle farming, traditional beer brewing, hair salons and brick making, are some examples of the uses of water for income generation. While some of these activities are lifestyle improvements (as opposed to profit orientated activities) they provide goods and services for poor households, and for some form an important element of their livelihood strategy.

The following research questions were asked referring to these activities:

- How much water is used for these productive activities?
- What are the economic benefits generated by rural households from these activities?

7.3.1 Water consumption

Seven activities were identified as the main productive activities that currently make use of domestic water (see definitions in Chapter 1), these are: Vegetable gardens, fruit trees, making bricks for building, brewing traditional beer, making ice-blocks, hair salons and livestock rearing.

Importantly, all **economic activities using domestic water occur over and above the first 25 litres**. Therefore, if one of the objectives of securing access to water for rural inhabitant is to improve the range of economic options available to impoverished rural South African, this will only happen when they are able to access quantities of water over and above 25 l/p/d.

Generally, when consumption for productive purposes is averaged across all individual in the village regardless of whether they themselves undertake the activity or not, an **additional 25 to**

40 l/p/d will be needed to support these economic activities (given current proportion of household involvement in the activities and water consumption).

Furthermore, the comparisons between consumption in "best case" and "worst case" villages provide an indication of the likely increase in water consumption with improved water supplies. The activities using most water are cattle production, vegetable gardens, beer brewing and watering of trees. When consumption for livestock is not included in the picture (reason this exclusion are discussed in Section 4.8.1), people in "best cases" use 4 times more water for productive uses than people in "worst case" villages (24.4 l/p/d versus 5.8 l/p/d). When water for livestock is included the total consumption for productive uses is approximately double in "best case" villages (40.4 l/p/d versus 23.3 l/p/d). Water consumption for all activities except for ice-blocks, is much higher in best case villages. The most important increases occur in the irrigation of gardens (950%), irrigation of fruit trees (286%), building activities (138%) and beer brewing (80%). (See Figures 4.3 and 4.4)

Moreover, other than using more water for productive purposes, the proportion of households (out of the total in each village) involved in these activities is also higher in "best case" villages than in "worst case villages". This proportion is higher for vegetable gardens (45% versus 14%), irrigation of fruit trees (73% versus 41%), building (57% versus 40%) and ice-block making (13% versus 6%) (see table 4.2).

Furthermore, in "best case" villages there is also a higher percentage of households that engage in multiple productive activities at the same time. Out of the total number of households in best cases, 98% of them (95% in worst cases) were involved in at least 1 of the activities listed above. Additionally, 60% (versus 38%) were involved in 2 of them and 11% (versus 3%) were involved in at least 3 of them (see Chapter 4, page 62).

Nonetheless, these results need to be qualified. Water supply situation is not the only difference between the two types of villages and, therefore, some of the recorded differences may arise from factors that the research team was unable to control for in the selection of case study villages (see Section 2.2.3). Only in the case of Utha was it possible to undertake a "before and after" assessment of water use following the improvement in the water supply of the village through a water project funded by AWARD (see Appendix 3.2). The results from this study show that after the improvement, the main increase in the use of water for productive uses were for building, brick making, irrigation of gardens, livestock watering and beer brewing.

A further issue relates to the fact that in "best case villages" water is not paid for and, therefore, the only limiting factor to water use is availability and not cost. This may result in water wastage and consumption over and above the real needs for each activity. In other words, the figures obtained in the research are not water demand figures for each activity as they are not linked to any consistent price structure.

Finally, the use of average consumption figures to estimate water needs for each activity needs to be done judicious. As indicated above, an extra 25 to 40 l/p/d would be needed, on average, in order to support the current level of involvement in "low level economic activities". However, this quantity of water reflects an average value when estimated across all households, regardless of whether each household engages in the activity or not. Clearly then, the amount required for each business is much higher than the above average. For example, in "best case" villages, the average water consumption for garden irrigation in households with gardens was 32 l/p/d[2]. Watering cattle required 70 l/p/d[3] in cattle owning households, beer brewing 28.4 l/p/d[4], and

[2] Compared to the average of 12.6 l/p/d
[3] Compared to the average of 14.5 l/p/d
[4] Compared to the average of 0.09 l/p/d

irrigating fruit trees 12.7 l/p/d[5]. Also in this case, water use figures per activity in "worst case" villages are much lower in most cases (see Figure 4.1).

7.3.2 Economic benefits

The economic significance of water based activities was measured by looking at the income generated from each activity. Gross margins[6] per litre of water were calculated for each activity and then multiplied by the average consumption to derive income per person and per household (see Chapter 5 for details). The limitations of the results presented below relate to the fact that neither the cost of the labour input to each activity, nor the price of water were included in the calculations of gross margins. Further research should be conducted to include these factors (direct and/or indirect cost of engaging in the activities, including the time spent in fetching water) and to refine the gross margin figures presented here.

Gross margins per litre of water used show a wide variation across activities. Ice-block making provided the highest return (1.7 R/l) followed by beer brewing (1.05 R/l) and hair salons (0.84 R/l). Building was next (0.3 R/l), followed by livestock rearing (0.025 R/l), fruit trees (0.02 R/l) and vegetable gardens (0.013 R/l). Returns for the last three were one order of magnitude smaller as these activities are relatively more intensive in water use (see Figure 5.1).

Paradoxical as it may seem, the highest rates of involvement in "low-level economic activities" are for those activities with the lowest returns per litre of water. In contrast, beer brewing and ice-block making activities providing the highest returns per litre, have the lowest rate of households involvement. This is the case for fruit trees and vegetable gardens. Possible reasons for this are as follows:

- The objective of the activity vary:

i) Activities with highest returns (beer brewing, hair salons, ice-block making) are mainly undertaken for commercial purposes. Most of the product is sold in market in order to generate cash income. Hence, the extent of the activity depends very much on the size of the market. As markets for these activities tend to be very local (one village), there are only a maximum amount of such businesses in any given village.

ii) On the other hand, activities with comparatively lower returns such as fruit and vegetable production normally have a dual purpose, namely, commercialisation and self-consumption. In the case of back-yard private gardens, the household normally consumes most of the production. Estimations of self-consumption varied from 50% to 80% of the product for the biggest backyard gardens and 100% for the smallest ones. Therefore, as the size of the market is not the main factor driving the decision to grow fruit trees and vegetables, these activities are the most likely to happen when access to water improves.

- Margins from irrigation of gardens and trees may be low but the welfare impact, and the economic benefits for those who engage in this activity, can be much higher. The health benefits derived from a more diverse diet and the regular consumption of fresh fruit and vegetables are widely acknowledged. Furthermore, having access to small but reliable sources of income from gardens and fruit trees can contribute to lower income insecurity and allow for the benefits to be reinvested in other activities. A pilot project using productive water points to irrigate gardens in southern Zimbabwe states that: "*For women with little access to cash, materials or productive resources, obtaining a steady seasonal income from the scheme has greatly lowered elements of risk and income insecurity in he households*

[5] Compared to the average of 8.5 l/p/d
[6] Gross margins = Income minus operating cost. Capital cost for the activities were not included.

decision making and planning processes." Also, reliable income flows have allowed the *"revival and blossoming of 'revolving funds' at productive water points"*. (Lovell, 2000).

Total income generated from 'low-level economic activities' **averages R529 to R653 person/year.** In other words, the 25 to 40 extra litres of water per person per day support the activities that generate the above-mentioned income for the average household. This income reflects an average value for all activities when estimated across all households, regardless of whether each household engages in the activity or not (under current proportion of household involvement and water consumption).

Also, the comparisons between consumption in "best case" and "worst case" villages provide an indication of the likely increase in income derived from improved water supplies. The activities generating most income are building, cattle ranging, vegetable gardens, fruit trees and brewing traditional beer. When consumption for livestock is not included in the picture (reasons for this are discussed in Section 4.8.1), people in "best cases" generate 2.5 times more income for productive uses than people in "worst case" villages (R529 p/y versus R212 p/y). When income from livestock is included the total consumption productive uses is approximately double in "best case" villages (R653 p/y versus R361 p/y). (See Figures 5.3 and 5.4)

For the same reasons cited in the previous section, the use of the average income figures per activity needs to be done cautiously. When considered individually, an average brewer in a "best case" village obtained R1283 per year. Hair salons obtained the second highest margins R704 p/y, followed by builders (R602 p/y), ice-block makers (R590 p/y), cattle owners (R591 p/y), vegetable garden growers (R152 p/y) and fruit trees owners (R95 p/y). (See Table 5.2).

7.3.3 Livelihood[7] impact and policy implications

In order to assess the importance of "low-level economic activities" for rural livelihoods in Bushbuckridge, the income derived from these activities was compared to income levels in the area. Income figures for BBR (Mhala and Mapulaneng magisterial districts) were obtained from the 1996 census. These figures showed large income disparities in the area, with 80% of the people earning no income, 14.4% earning between R1 - R1000 per month, and 4.4% earning between R1000 - R3500. The weighted average for all people was R175.5 per month (or R2106 per year).

When these figures are compared to the estimations of gross margins reported in the previous section, they show that:

- In "best case" villages annual gross margins from "low-level economic activities" amount to the equivalent of 25% of all income earned by an average individuals. In "worst case" villages the percentage decreases to 10% of the average income.

- As most of these activities are part of the "informal sector" of the economy, and some of them do not provide monetary income for the individual, it is unlikely that they are accounted for in the estimations of individual income from the census. This may result in under-estimations of income levels for the area that can be as large as 25% of the existing figures.

These results offer a first assessment of the role of productive water use in rural livelihood systems in Bushbuckridge. However, the insight into rural livelihoods provided by this research is somewhat limited. At inception, the research was not designed as an analysis of livelihoods.

[7] Livelihoods are defined as: 'comprising the capabilities, assets (including both material and social resources) and activities required for means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base' (DFID, 1998. Adapted from Chambers and Conway, 1992)

Instead, a sectoral approach was adopted taking the uses of domestic water as the entry point to gain a better understanding around the amounts of water used for each activity and the levels of return expected from them. How these water-based livelihoods feature in the overall livelihood strategies for rural households remains largely unanswered and should be the focus of further research. For example, this research has already acted as a catalyst for further research that, building from the results presented here, will broaden the focus to respond to questions such as:

- When (seasonality) and why rural households engage in each of the businesses,
- How do this activities contribute to the main kinds of capital assets featuring in sustainable livelihoods, namely: natural, physical, human, social and financial capital
- What are the main constraints and opportunities around each of the activities
- How do households prioritise amongst the different strategies. Which ones are the most preferred ones and why?
- Who in each village undertake what activity? Are there any differences depending on the wealth?
- Who within each households has control and benefit most from these water based activities (gender and age analysis)
- What are the main support strategies that should be considered to enhance water based livelihoods
- What are the limits to the generalisation of these activities if more water was available (see Butterworth et al 2001 and visit www.nri.org/WSS-IWRM/Index.htm)

The evidence from Zimbabwe (Lovell, 2000) shows that the livelihood impact of increased access to water for productive uses can be very important. Income from productive water points (mainly used for vegetable production) has created opportunities for those with limited access to cash. or productive resources, to start their own income-generating activities. As stated by Lovell, it has been shown how obtaining a steady seasonal income from a productive water point lowers elements of risk and insecurity in the household budget and decision making process. Surveys carried out at standard (non-productive) domestic water points draw attention to the difference that a secure source of income from a productive water point can make in enhancing broader production systems.

Furthermore, the implication for the RWSS sector are also far reaching, given the growing concerns about cost recovery and **sustainability**. The ability of the rural poor to access increasing amounts of water quantities will not just be determined by the availability of the water (supply side), but mainly by their ability to carry the costs of the water and its supply (effective demand / ability to pay). The ability to pay, in turn, can only be enhanced by increasing the economic opportunities of the rural poor and, as we have seen before, **accessing water for productive uses (over and above the basic needs (25 l/c/d) may be a necessary condition for this.**

In other words, the rural water sector policy should not only be driven by the supply of "basic needs" but also by the economic opportunities that the access to additional water can generate in rural areas. Unfortunately, despite the growing interest about the importance of water for rural livelihoods, the Department of Water Affairs & Forestry (DWAF) still has no mechanism for allocating water to this sector, nor is it formally incorporated in any water balance models.

7.4 PAYMENTS FOR WATER AND WILLINGNESS TO PAY

The extent to which there is an effective demand for water in rural areas is of great interest to policy makers and planners in South Africa. In the context of DRA (see Chapter 1), the need to recover the cost of water service provision is now accepted as a priority for the sector (DWAF 1994; DWAF 1997a,b; Jackson 1997; Jackson 1998). The argument is that effective cost-recovery mechanisms are necessary to ensure the sustainability of the water supply systems. It generates a feeling of ownership of the water systems by the community and, most importantly, it is the only way of ensuring the financial sustainability[8] of service providers, and therefore, their ability to continue the service provision into the future.

Although the debate around payment for water is high on the water policy agenda, implementation is a controversial issue in Bushbuckridge, as in much of the rest of South Africa. A plethora of socio-economic, political and historical dynamics have resulted in a complex reality characterised by a set of related factors and constraints that shape people's experiences and perceptions about payment for domestic water supplies (see Chapter 6).

Moreover, as controversial as it is, the debate around cost recovery and payment for water is also confused by a series of assumptions around the rural domestic water sector that are too often incorrect and contribute to an incomplete analysis of reality. These are:

- People in rural areas do not pay for water
- Ability to pay for water is the main problem. People are willing to pay but due to the existing levels of poverty, they cannot afford to.

Against this background the research set out to answer two relevant questions;

- Do people pay for the water in Bushbuckridge?
- Are people willing to pay for the water? What factors affect "willingness to pay" for water?

7.4.1 Payments for water

That rural inhabitants do not pay for water cannot be assumed in general. Evidence from this research indicates that the opposite may well be the case. Prices paid by rural households can be much higher that prices paid in areas where proper cost-recovery mechanism are in place.

Formal arrangements for the payment of water are absent from most villages in Bushbuckridge.. They exist in some of the declared township of the area (Thulamahashe, Dwarsloop, Mkhuhlu) but these systems do not operate in most cases. Other existing arrangements for payment of services do occur in rural areas, in projects sponsored by NGOs such as the Mvula Trust and AWARD. They pertain to water supply systems for specific communities and are normally managed by a community structure (normally a water committee) that oversees money collection and manages the revenue generated. Payments normally take the form of flat tariffs paid monthly by all households in the village.

However, water is frequently paid for through non-formal systems and it is a very expensive commodity for many households. Water-vending is a common business in Bushbuckridge (for a typology of water vendors encountered in the area see Chapter 6). Direct water-vending activities were recorded in five "worst case scenario" villages (see Table 6.2). Although some people in "best case scenario" villages also reported buying water, they indicated that this only happened sporadically and it was normally linked to celebrations and functions when large quantities of water were required in a very short period of time.

Prices paid are well in excess of those paid in areas with regularised household connections and unlimited access to water. They also show a large variation from village to village and from vendor to vendor within the same village. The range of prices encountered varied from R0.25 for 25 litres (MP Stream C) to R2.50 per 25 litres (Mabharule), with prices around R0.20 to R0.50 per 25 litres being the norm in most villages were vending activities were recorded.

[8] Sustainability is defined here as: the benefits of the water-supply project continuing indefinitely in a reliable manner at a level genuinely acceptable to the community it serves and close to the design parameters, without an unacceptable level of external managerial, technical or financial support (DWAF 1997b)

In “best-case villages” most households obtain water free of charge, this may involve making unauthorised connections to main pipes running through the village. Although in some areas households request permission to connect to the network, in most places connections are not regulated and are performed when the need arises. Households buy the materials and contract local plumbers or make the connections themselves. In Xanthia and M&B some households indicated that the cost of making a connection varies from R180 to R400, including material and labour costs.

The second assumption that needs to be revised is that poor people cannot pay for water. Whereas low affordability is a reality for many rural households evidence shows that it is likely that the poorest people in Bushbuckridge area are facing the highest prices for water.

Prices per m^3 of water are one order of magnitude higher in rural communities than in declared townships and neighbouring towns (see Table 6.3). Moreover, when comparing these prices with those paid in other areas of the country, prices for domestic water in some of the Bushbuckridge villages are well in excess of prices paid in some of the richest households in the country, for instance, in areas such as Greater Hermanus.

Nevertheless, the issue affordability needs to be separated from that of having to pay and how much. The two are different questions and the evidence showing that poor people can, and do, pay for water should not imply that the priority for the sector is to make poor people pay for water.

The fact that rural people are paying the highest prices for water indicates that there is room for manoeuvre. In some cases, where the need for payment for water is justified, implementing a formal payment system with tariffs reflecting local conditions and choice of level of supply can improve the situation of the poorest (some degree of cross subsidization is possible)

7.4.2 Willingness to pay

It is generally argued that willingness to pay decreases dramatically once an improved water system is in place. This seems to hold even if the price for water from the new system is lower than those paid to the traditional vendors. This has serious implications for water policy, particularly when trying to implement effective cost recovery mechanisms. Therefore, understanding the extent to which people are willing to pay for water, and the factors that affect willingness to pay are crucial tasks for policy makers and water service providers.

The extent of water vending activities in the area, analysed in the previous section, would point to a high demand for improvement in the water systems. This is generally true for most villages in Bushbuckridge. However, when asked whether they would be willing to pay for such an improvement people in most villages raised a number of questions that indicated that willingness to pay for water in the area may be low. The reasons varied and had to do with cultural, political, institutional and economic factors (see Section 6.3).

In conclusion, reasons why people decide not to pay for water are complex and in many instances can not be attributed to a single cause. Understanding these reasons and perceptions must become a priority for policy makers and water service providers due to the potential effects on cost recovery and ultimately on project sustainability.

7.5 FINAL CONSIDERATIONS

This research has tried to contribute to raising the profile of the productive uses for water in rural areas in an attempt to bridge the information gap exiting about this sector. It has also indicated the pressing need to ensure allocation of water for productive uses so as to realise its potential benefit order in terms of enhancing livelihood options for rural people in Bushbuckridge. There are, however, many challenges ahead of us. This research has provided insight into some key issues, whilst others are to be answered through further work. These are some of these:

- A better understanding of the water-based livelihood implications (see section 7.3.3)
- Ensure effective mechanisms to allocate water to this sector
- Assessment of feasible and viable technical options for supplying the extra water needed. Alternative ways of providing the water need to be explored. There is already evidence showing that, in some circumstances, providing this water through current domestic water systems may not be most effective way (see experience with collector wells in Zimbabwe, in Lovell 1990). Some creative thinking will be needed from engineers and technical experts in order to provide solutions that are appropriated to the South African context.
- The provision of water for productive uses needs to be done without compromising the provision of basic needs. Evidence from India indicates that, in the context of a dramatic increase in groundwater extraction for small-scale irrigation during the last ten years, domestic water supplies are becoming increasingly threatened as a consequence of groundwater depletion and increasing demand (Batchelor et al. 2000).
- Appropriate institutional mechanisms and management tools (at local, regional and national level), including tariff structures and cost recovery mechanism need to explored so as to ensure the sustainability of the systems.

REFERENCES

Alcock, P. 1986. *"An examination of household water consumption in the Inadi ward, Kwazulu."* The Civil Engineer in South Africa.

AFRICON Consortium. 1998. *"Report on Bulk Water Supply for the Bushbuckridge and Northern Nzikasi Areas: Strategic Plan"*. Report compiled on behalf of DWAF, Eastvaal District Council, Highveld District Council, Lowveld & Escarpment District Council, Mvula Trust & Rand Water.

Batchelor, C. et al. 2000. *"Karnataka Watershed Development Project. Water Resource Audit".* KADWAD Report 17. June 2000. DFID

Berman, P., et al. 1994. *"The household production of health: integrating social science perspectives on micro-level health determinants."* Social Science and Medicine, vol. 38, No.2, pp. 205-215

Black, M. 1999. *"1978-1998. Learning what works. A 20 year retrospective view on international water and sanitation cooperation."* UNDP- World Bank
Water and Sanitation Programme.

Breslin, N. 1999. *" Reflecting on the South Africa Water Sector"* in Water and Sanitation News, vol.6, No.1, January-April 1999. NETWAS INTERNATIONAL

Butterworth, J., Mokgope, K., Pérez de Mendiguren, J.C. and Pollard, S.R. (2001). *"WHIRL Project. Research Planning Internal Report".* South Africa 2001

Boydell, R. A. 1999. *" Making rural water supply and sanitation projects sustainable"* in Waterlines vol.18, No.1, July 1999. Intermediate Technology Publications.

Carney, D. (ed) 1998. *"Sustainable Rural Livelihoods. What contribution can we make?"* DFID. London 1998

Chambers, R. and Conway, G. 1992. *"Sustainable Rural livelihoods: Practical concepts for the 21st century"*. IDS Discussion Paper 296. Brighton 1992.

Chunnett, Fourie & Partners. 1990. *"Water Resources Planning of the Sabie River Catchment"*. Vol. 1- 10. SA 1990

Conningarth Consultants. 1994. *"Sabie-Sand River Water Resources Development: Macro-economic and cost-benefit analyses with reference to the proposed Injaka Dam"*. Prepared for the Sabie Steering Committee. SA 1994

Consultburo, Afrosearch-Index, and Fundile Africa. 1996*. "Survey of unauthorised connections in water supply schemes in the Northern and Mpumalanga provinces"* Department of Water Affairs and Forestry. South Africa 1996.

Dabbagh, T.T. 1991. *"The constraints on the water supply and sanitation sector in the developing countries"*. In Water Supply and Sanitation Collaborative Council, Global Forum. Oslo. Sept 18-20

DBSA 1986. *"Gazankulu Development Information. Vol I and II"*. Development Bank of Southern Africa, Midrand 1986

DBSA 1990. *"Development Information Region G*". Development Bank of Southern Africa, Midrand 1990

Department of Water Affairs and Forestry (DWAF). 1994. *"Water Supply and Sanitation Policy. White Paper".* RSA 1994

Department of Water Affairs and Forestry (DWAF). 1997a. *"White Paper on a National Water Policy for South Africa".* RSA 1997

Department of Water Affairs and Forestry (DWAF). 1997b. *"Implementing Prepayment Water Metering Systems"*. RSA 1997

Dreyer, L. 1998. *"The dynamics of community non-compliance with basic water supply projects."* Water Research Commission Report No TT 93/98. South Africa

Garn, M. 1998. *" Managing water as an Economic Good*". Paper presented at the Community Water Supply and Sanitation Conference. May 5-8 1998. Washington DC

Jackson, B.M. 1997. *"Financing Water Management in South Africa"*. Presented at AIC Water Conference. Gauteng, 24 & 25 March 1997

Jackson, B.M. 1998. *"Rural and peri-urban water supplies in South Africa: financing issues.*" Presented at DWAF Workshop on higher levels of services. Midrand, 10th of February 1998. South Africa.

Lovell, C. 2000. *"Productive water points in dryland areas. Guidelines on integrated planning for rural water supply"*. ITDG. London 2000

Mu, X., et al. 1990. *"Modeling village water demand behaviur: A Discrete Choice approach "* Water Resources Research, vol. 26, No. 4, pp. 521-529

Mc Phail, A. A. 1993. *"The 'five per cent rule' for improved water service: Can households afford more?"* World Development, vol. 21, No. 6, pp. 963-973

Orkin, F.M. 1998. *"Living in the Northern Province. Selected findings of the 1995 October household survey"* Central Statistics. South Afirca 1998

Orkin, F.M. 1999. *"Census in brief"*. Statistics South Africa 1999.

Perez de Mendiguren, J.C. 1998. *"Water policy hits the rural poor"* in Pickford J. (ed): Sanitation and Water for All. Proceedings of the 24th WEDC Conference. Islamabad. Pakistan 1998

Pollard, S.R., J.C. Perez de Mendiguren. et al. 1998. *" Save the Sand Phase I. Feasibility Study: The development of a proposal for a catchment plan for the Sand River Catchment"* Report submitted by AWARD to the Department of Water Affairs and Forestry. South Africa 1998.

Rosen, S., and J. R. Vincent. 1999. *"Household water resources and rural productivity in Sub-Saharian Africa: A review of the evidence."* Harvard Institute for International Development . Development Discussion Paper No. 673

Sara, J., and T. Katz. 1998. *"Making rural water supply sustainable: Report on the impact of project rules."* UNDP- World Bank Water and Sanitation Programme.

Shackleton, C.M. et al. 1999. *"The direct use value of goods and services attributed to cattle and goats in the Sand River Catchment, Busbuckridge"*. CSIR. Pretoria

The World Bank Water Demand Research Team. 1993. *"The demand for water in rural areas: determinants and policy implications."* The World Bank Research Observer, vol. 8, No.1, pp. 47-70

Tollman, S.M et al. 1995. *“The Agincourt demographic and health study: Phase 1. Monograph published by Health Services Development Unit (HSDU)”.* Acornhoek. South Africa 1995.

UNDP-World Bank Water and Sanitation Programme. 1998. *“Community Water Supply and Sanitation Conference. Proceedings.”* Washington, 5 – 8 May 1998.

USAID 1997. *“ Issues and Options for Transfer of Water Distribution Responsibility to Local Government Structures in Busbuckridge, Hayview and Nsikazi North Areas of South Africa”.* Activity Report No.30, November 1997

Van Schalkwyk, A. 1996*. “Guidelines for the estimation of domestic water demand of developing communities in the Northern Transvaal.”* Water Research Commission Report No. 480/1/96. South Africa 1996.

VSA Geoconsultants. 1997. *“ Preliminary report regarding the yield testing results of existing boreholes within the Bushbuckridge district”*. Report to DWAF

VSA Geoconsultants. 1998*. “Preliminary geohydrological report of the Bushbuckridge area’*. Report to DWAF.

White, G. F., D. J. Bradley, and A. U. White. 1972. *“Drawers of Water: Domestic Water Use in East Africa”*. Chicago: University of Chicago Press.

Whittington, D., et al. 1991. *“A study of water vending and willingness to pay for water in Onitsha, Nigeria.”* World Development, vol. 19, No. 2/3, pp. 179-198

Woodhouse, P. 1995. *“Water rights and rural restructuring in South Africa: A case study from Eastern Transvaal.”* Water Resources Development, vol. 11, No. 4, pp.507-544

APPENDIX 3.1

SUMMARY STATISTICS FOR HUMAN CONSUMPTION AND HYGIENE (HC), WASHING CLOTHES (W) AND TOTAL BASIC CONSUMPTION (HC+W)

Litres per capita per day (l/c/d)

	HUMAN CONSUMPTION AND HYGIENE						WASHING CLOTHES						TOTAL BASIC CONSUMPTION					
	n	*Avg*	*Median*	*Mode*	*Range*	*St.Dev*	*n*	*Avg*	*Median*	*Mode*	*Range*	*St.Dev*	*n*	*Avg*	*Median*	*Mode*	*Range*	*St. Dev*
Shortline	17	19.2	15	12.5	8.3 - 37.5	10	14	4.4	4.5	7.2	1.4 - 7.1	1.9	17	22.8	16.8	12.5	10 - 44.5	12
Dinglydale	22	18.2	15.6	25	6.3 - 45	9.5	23	4.7	3.6	3.6	1.8 - 14.3	3.4	22	22.4	18.3	32.1	8 - 45	10.4
Boshoek & Matafeni	28	15.1	13.2	16.7	5 - 35.7	7.6	32	5.3	2.8	2.4	1.3 - 17.9	4.4	27	20.4	18.4	25	7.7 - 51	10.1
Utha	5	20.8	21	16.7	11.8 - 32	7.5	4	6.8	6.5	3.4	3.4 - 10.7	3.9	4	27.1	25.3	15.3	15.2 - 42.7	11.4
Xanthia “A”	20	15.6	14.3	10	6.3 - 37.5	7.4	22	5	4.3	4.3	1.3 - 11.9	3.1	19	21	20.4	14.3	8 - 48.2	10
Kildare “B”	25	16.5	16	12.5	6.9 - 25	5.1	27	4.3	4.2	3.6	1.8 - 9.6	1.7	25	20.7	20.8	19.3	11.1 - 32.1	5.4
Dixie	17	19	18.8	12.5	9.4 - 37.5	7.2	16	5.2	4.5	3.6	1.8 - 12.5	2.8	17	23.7	23.8	28.6	11.1 - 50	8.7
Tsakane	26	14.1	12.5	12.5	5 - 37.5	8.5	17	5	4.3	2.4	2.1 - 9.5	2.6	17	19.3	16.8	15.2	7.1 - 44.6	11.4
MP Stream “C”	-	-	-	-	-	-	-	-	-	-	-	-	43	18.8	16.7	25	5.8 - 41.7	8.7
Itereleng	16	18.2	17.5	16.7	5.7 - 33.3	6.1	13	5.2	4.8	4.8	2.1 - 11.9	2.5	15	22.8	21.8	26.4	5.7 - 45.2	8.4
Violetbank “F”	-	-	-	-	-	-	-	-	-	-	-	-	25	22	23.6	12	7.5 - 50	11
Township	35	16.4	15	12.5	5 - 41.7	8.1	30	5.4	5	5.4	1.1 - 17.9	3.5	32	20.9	18.9	17.1	9.8 - 38	7.8
Mabharule	11	16.4	16.7	18.8	6.8 - 25	5.4	7	3.3	2.4	1.8	1.5 - 6.4	1.9	12	21	18.6	18.8	6.8 -50	11.1

APPENDIX 3.2

IMPACT ASSESSMENT OF UTAH WATER PROJECT

INTRODUCTION

Three days were spent in Utah village as part of the research to assess the economic impact of improved water supplies. Utah provides a useful case-study since a project was recently completed (November 1996) to improve the supply to the village.

Until 1995 there was no water reticulation system. The whole village collected water at a single collection point close to the borehole. An average of 20 l/p/d was supplied when the borehole was running at its full capacity. Distance to the collection point was longer than the 200 metres for all households.

The project funded by AWARD started in March 1995 and lasted until late 1996. It installed reticulation system and communal taps less than 200 metres from each household. There was not improvement in the yield of the borehole. However, improved community management allowed for a more efficient use of the source, increased reliability and proximity to the source.

Seasonal sources existed prior to the project. These have now been replaced by the reticulated supply.

Utah has approximately 221 stands, and an estimated population of 1250.

DESCRIPTION OF IMPACT

Domestic water use: all of the people interviewed stated that the quantity of water they collect for their normal daily use had not increased. However, the stress of water collection has decreased significantly due to reduced distances and lack of queuing. Prior to the improve system, people used to spend many hours queuing for water. The committee had restricted collection to three containers per person at one time. During the study no queues were observed at water points.

Many people reported increased clothes washing. This is particularly the case for poor families with school going children who are forced to wash uniforms daily to ensure that the children are wearing the correct uniform.

Health: since there has been no increase in domestic water use other than for washing, and there was no health education component to the project it is doubtful if there have been any health improvements, other than reduced physical strain on the collectors.

Building: the most significant increase in water use has been building. Virtually every stand has been building in the last six months. People make their own concrete bricks and employ local builders to build the houses.

Gardens: most stands are now collecting additional water for gardening. Gardening ranges from decorative plants, fruit-trees and vegetable gardens. Vegetable gardens are being promoted by the Commuity Rehabiliation Worker based in the village, and most people reported that they either have a vegetable garden or are planning one.

Brewing: there is a significant amount of home-brewed beer sold in the village (at least 2000 litres per month, at a cost of R2 per litre). The quantity produced has increased but not dramatically since the improvement of the water system. Beer is particularly important for functions and traditional worship

Livestock: large numbers of livestock were lost in the 1992 drought, and people have been reluctant to invest in livestock since then due to lack of secure water sources. Since the completion of the project there have been significant increases in livestock numbers.

Business: there are a number of businesses in the village (2 stores, bottle store, butchery). None of them reported changes water usage, other than the Utah store which used to provide water for its customers and the school children.

Car Washing: there has been some increase in the amount of water used, however, in the past waste water was used, whereas now it is clean water. There are 29 cars in the village.

School Feeding Scheme:prior to the project pupils had to each carry 5 litres of water to school for the cooking. Now water is available at the school.

Hair saloons: there are 3 hair saloons in the village

Functions: water is used for celebrations, funerals etc. There was a reported large increase in the number of functions held in the village. The increase was reported as increasing from 21 in the six months before the improvement in water supply, to 39 since the supply was improved.

Time Trend of Water Use

Activity	Water useage before project	Water useage now
Building	2	12
Irrigating gardens	3	11
Brick making	4	18
Livestock	2	6
Beer	3	5
Feeding scheme	4	6
Vegetable gardens	1	5
Cattle dip	2	3
Hair saloon	2	3
Businesses	5	7
Car washing	2	4
Functions	14	40

APPENDIX 3.3

SUMMARY OF RESULTS FROM MEETING IN DWARSLOOP

Objective: To gain general understanding of the uses of water in Dwarsloop
Duration: 90 minutes
Attendance: 11 people. 9 male and 2 female. All of them were members of village level institutions (water committee, civic and women group)
Procedure:

- A brief rough map of the Township was done just to lead people if there was any particular area of the town that is relatively better supplied.
- Participants were asked to list all uses of water in the town and rank them according to whether the use of water for this activity was high, medium or low. Ranking indicates the participant's experience of the Township, not their personal use for the activity.

Results:

	Respondents												**Scores**				**Total**		**Ranking**
Activities													Hi	Me	Lo				
Car Wash	1	0	0	0	0	0	0	1	0	1	0		0	3	8		3		**8**
Lawn	2	0	0	2	2	2	2	1	1	2	1		6	3	2		15		**5**
Gardens	1	1	0	1	1	1	1	2	1	2	2		3	7	1		13		**6**
Fruitrees	1	1	2	2	2	0	1	2	0	1	1		4	5	2		13		**6**
Sanitation	0	1	2	2	2	2	1	2	2	2	2		8	2	1		18		**3**
Washing	2	2	2	2	2	2	2	2	2	2	2		11	0	0		22		**1**
Drinking	0	2	2	2	2	2	1	2	2	2	2		9	1	1		19		**2**
Weddings	2	1	1	1	1	1	2	2	2	1	2		5	6	0		16		**4**
Funerals	2	1	0	1	1	1	2	2	2	1	2		5	5	1		15		**5**
Parties	1	1	0	1	1	0	1	1	1	1	1		0	9	2		9		**7**
Flowers	0	1	0	2	2	2	1	1	2	1	0		4	4	3		13		**6**

2 = High usage
1 = Medium usage
0 = Low usage

The first column illustrates the main water usage in the township according to the participants experience. The subsequent columns indicate ranking of the usage level per participant according to the above criteria.

APPENDIX 3.2

LEVEL OF LIVING INDEX OF THE COMMUNITY

(Based on A. Van Schalkwyk, 1996. Own elaboration)

	LEVEL OF LIVING INDEX							
		1	**2**	**3**	**4**	**5**	**6**	**7**
		VERY LOW	**LOW**	**LOW TO MODERATE**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**VERY HIGH**
INDICATOR	Income (R/hh/month	< 300	300 - 600	500 - 1000	700 - 1300	1000 - 1700	1300 - 2500	> 2500
	Education (% with no education)	> 50	45	35	25	15	< 5	0
	Dwelling construction	Limited traditional, untreated cement blocks, clustered	Untreated cement blocks	Limited painted cement block	Painted cement block /informal housing	Painted cement block / limited western / improved informal	Moderate western, small stands	Western large stands
	Agricultural activity (LSU/person)	> 0.7	0.6	0.4	0.2	0	0	0
	Population	< 1000	2000	3500	5000	8000	-	-
	Business activity in dormitory residential areas	Extensive	Extensive	Moderate	Moderate	Limited	Limited	Limited
	Electricity connnections (% households serviced)	0	0	10	35	50	80	100
	Pirate connections (% households)	0	20	50	70	90	100	100
	Household size (people per household)	> 8	7	6	6	5.5	4.5	4

APPENDIX 4.1
SUMMARY STATISTICS FOR LIVESTOCK OWNERSHIP
N. of cows and goats

	COW OWNWERSHIP IN CATTLE OWNIING HH.						GOAT OWNERSHIP FOR GOAT OWNING HH.					
	n	***Avg***	***Median***	***Mode***	***Range***		***n***	***Avg***	***Median***	***Mode***	***Range***	
Shortline	2	3.5	3.5	5	2 – 5		3	6.6	4	4	4 – 12	
Dinglydale	7	9.3	7	10	4 – 22		7	6.5	6	6	3 – 12	
Boshoek & Matafeni	9	8	6	10	2 – 20		3	7.3	6	6	6 – 10	
Utha	43	8.8	8	8	2 – 37		42	9.3	8	5	2 – 33	
Xanthia “A”	8	7.1	5.5	2	2 – 21		11	9.4	10	5	3 – 19	
Kildare “B”	5	7.8	6	4	2 – 16		4	5.3	4.5	3	3 – 9	
Dixie	8	5.5	6	2	2 – 8		11	10.8	9	13	3 – 22	
Tsakane	8	7.8	9	9	1 – 14		9	5.6	5	2	1 – 13	
MP Stream “C”	22	11.2	11	15	2 – 24		27	8.7	6	2	2 – 46	
Itereleng	1	8	8	8	8 - 8		1	5	5	5	5 – 5	
Violetbank “F”	0	0	0	0	0		4	1.7	2	2	1 – 2	
Township	4	6.25	6	5	5 – 8		7	8.4	7	8	4 – 21	
Mabharule	1	13	13	13	13 - 13		?	?	?	?	?	