BASIC SANITATION SERVICES IN SOUTH AFRICA

Learning from the past, planning for the future

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Executive Summary

South Africa's Department of Water Affairs and Forestry (DWAF) uses the slogan "Water is life. Sanitation is dignity" to promote universal coverage of water and sanitation for all. In fact both improved water supply and sanitation are known to be key requirements in the drive to achieve improved public health. In a survey of 11 000 readers conducted by the British Medical Journal in January 2007, improvements in sanitation were voted as the most significant cause of public health improvements in modern times, narrowly edging out antibiotics and anaesthesia (British Medical Journal, 2007).

At the World Summit on Sustainable Development in 2002 the importance of sanitation was recognised when the target *to halve, by 2015, the proportion of people without access to basic sanitation* was added to the Millennium Development Goals (Evans, 2005).[1] In 2004 the World Health Organization and UNICEF's Joint Monitoring Programme for Water Supply and Sanitation released their midterm assessment of progress, which showed that during the period 1990 to 2002 world sanitation coverage had improved from 49% to 58%. The MDG target implies that sanitation coverage must be above 79% by 2015. With the world population increasing all the time, realisation of the target will require the rate of sanitation delivery to double from 80 million to over 160 million people per annum.

In 2001 South Africa adopted a policy of free basic services for the poor. These services include water supply, sanitation, refuse removal and electricity. What does it mean to provide free basic sanitation to the poor? On 21 March 2009 the Minister of Water Affairs and Forestry approved the *Free Basic Sanitation Implementation Strategy (DWAF, 2009).* This document is intended to give Water Services Authorities a framework for planning and operating sanitation services for the poor. It provides substantial leeway to municipalities to determine how to go about this, depending on their geography, demographics, income distribution and capacity. In the Strategy's Section 6.4, titled *What are the limitations to providing the service free, in relation to capital and operating expenditure?,* the following guidance is given:

[1] The Millennium Development Goals (MDGs) are a set of targets to extend the benefits of development to a substantially increased proportion of the world's poor.

As noted in Section 6.1 it was implied that 'free' sanitation means that the poor household does not have to contribute towards the cost of providing the service initially (capital) and managing the service in the long term (operating). However, there are certain limitations in this regard:

Construction of new infrastructure and rehabilitation of infrastructure (Capital items):

- *Poor households will not be required to fund the capital cost of constructing the infrastructure necessary for a basic service but with the proviso that the water services authority may set a ceiling amount of capital to be allocated for construction per household.*
- *Where rehabilitation of infrastructure is required (a capital item), this will be provided free. But this excludes the 'on site' infrastructure which is the responsibility of the household with an exception described below.*
- *An exception may be made by the water services authority for the rehabilitation costs of pits or tanks, the underground infrastructure associated with 'on site' sanitation. Typically such an exception may apply to situations where it is not feasible to empty ventilated pit latrines and relocation of such pits is required. It may also apply to rehabilitation of collapsed pits.*
- *The rehabilitation of buildings, pedestals and pipework, which are part of the 'on site' facility, is the household's responsibility.*

Operating and maintenance of infrastructure

- *Households are responsible for the day-to-day operating costs of the 'on-site' component of the service. This includes providing anal cleansing material, cleaning the pedestal and the room or privy in which the toilet is located, and ensuring that solid waste is not discharged into pits or tanks.*
- *In the case of systems which require flushing, the household must ensure that the 'on site' water pipe work and flushing systems are fully functional and that water used beyond the limit set for free basic water is paid for.*
- *Day-to-day maintenance of the complete 'on site' facility is the responsibility of the household. This includes all repairs to pits, tanks, pipes, pedestals, flushing mechanisms and buildings in which the toilet is housed. However, an exception may be made with regard to sludge or compost handling, as described below.*
- *As far as possible, 'on site' sanitation systems should be designed so that the households can themselves manage the sludge or compost which is produced. However, where this is not possible the water services authority may arrange for a sludge or compost removal service to be provided to the household free.*

Source: DWAF Free Basic Sanitation Implementation Strategy, 2009

The drive to provide basic sanitation to all South Africans began in earnest only after the accession of full democracy in 1994. In the early years delivery was slow, with construction at scale only really beginning after the establishment of the new local government structures in 2000.

In 2003 South Africa adopted the Strategic Framework for Water Services (SFWS), which, inter alia, included 19 specific performance targets. Of the 19, the second target was to completely eliminate South Africa's sanitation backlog by 2010. The Monitoring and Evaluation Unit of the Department of Water Affairs and Forestry produces a quarterly "Consolidated Water Sector Report" under the aegis of the Masibambane programme. In the report for the quarter ended December 2008 the sanitation backlog is estimated at 3 311 512 homes, down from an estimated 4 759 709 at the time of the 2001 Census. At this rate South Africa appears to be on track to meet the MDG sanitation goal, although the goal of eliminating the full sanitation backlog by 2010 has proved to be too ambitious.

A key question, however, is whether the sanitation being provided is working well and whether local government and the beneficiaries are together capable of maintaining these services? In an attempt to throw light on this question, this report includes 18 case studies of different types of sanitation in different provinces, with between 4 and 12 years of operational history. It was found that there was no single type of sanitation that fared uniformly well. For example, at Ntuthokoville in Pietermaritzburg the waterborne sanitation which was provided in 1996 as part of the services upgrade to an informal settlement has worked very well, but the municipality is left carrying bad debts totalling tens of thousands of Rands per home. In Newline, Mpumalanga the VIPs continue to fulfil their function with no significant problems 11 years after construction, whereas at Mbazwana in northern KZN, after a similar time period, five out of twenty five VIPs inspected had collapsed, and at Inadi fifteen out of twenty-seven inspected were full. The UD toilets at Bereaville, Kammiesberg and eThekwini are generally working well, whereas those at Koel Park and Ekurhuleni have been disastrous. A common lesson is that communal sanitation is very prone to failure (and in this light it is interesting that the Joint Monitoring Programme of the WHO and Unicef do not recognise shared sanitation as meeting minimum improved sanitation requirements).

Another common lesson is that a failure to properly involve the community in the sanitation choice, in the sanitation implementation and in health and hygiene education is likely to result in poor functioning of the resulting latrines.

The report includes the results of a survey of over 1 000 people from poor rural or peri-urban communities, approximately half of whom have to date benefited from government sanitation projects. Although the new toilets were found in general to be cleaner and freer of flies and odour, it is a concern that there was no difference found between the two groups in the likelihood of a hand washing facility being found near the toilet.

The key design consideration for VIPs is how the management of faecal waste is to be allowed for. A typical pit filling rate is 30 litres per user per year, although significant variability is found in practice. Assuming an average VIP has six users, the sludge accumulation in 10 years will be 1.8 m^3. Allowing some freeboard, a pit should have a capacity of at least 2.5 m^3 if the emptying interval is to be, on average, once every ten years.

The emptying of single pit VIPs can be difficult and hazardous. For this reason planners should rather favour more easily maintained options such as movable VIP toilets (with lightweight top structures), twin pit VIPs (with relatively shallow and therefore more emptyable pits) or single or double pit UD toilets. Pour flush latrines, already very widely used in South East Asia, may provide a more affordable alternative to septic tanks or fully waterborne sanitation. In Asia, however, water is used for anal cleansing and this is important for the success of the pour flush option there. Further work is required to test the feasibility of pour flush or very low flush systems in South Africa.

The funding of the capital cost of new sanitation projects in South Africa is provided by the Municipal Infrastructure Grant. Current cost ceilings allowed for basic sanitation range from R5 000 (for VIP latrines) to R15 000 (for waterborne sanitation), and the contribution from the beneficiaries is usually limited to the digging of the pit, or to nothing at all. Funding for operation and maintenance is required to come from the municipal coffers. Strictly speaking the funding for operation and maintenance is covered by the Equitable Share grant, in terms of which municipalities receive an operations subsidy of between R40 and R60 per month for sanitation for every poor family in their area. However the Equitable Share is an unconditional grant and in practice this is <u>not</u> seen by local government as funding that <u>has</u> to be spent on operation and maintenance of basic services, and a significant portion is used simply to cover the overhead costs of municipal management and administration.[2]

The practice of building sanitation infrastructure while not allowing for adequate maintenance in the future, whether it is basic VIP sanitation or full waterborne sanitation, is short sighted and will result in South Africa facing a sanitation crisis in the medium term. In the next five

[2] For this reason Derek Hazelton was commissioned under this study to compile the report ***The New Local Government Equitable Share Formula and its Impact on Water Services.*** This report explains how the Equitable Share grant is calculated, and includes appendices with tables detailing how the grants are allocated to each of South Africa's municipalities, according to the population and according to which of the basic services (water, sanitation, refuse removal and energy provision) they provide. Line managers responsible for sanitation services in municipalities can use these figures to challenge their management to provide enough funding so that maintenance of sanitation services can be performed adequately.

years South Africa will have at least a million VIP latrines in need of emptying. In the longer term it can be expected that approximately 500 000 VIP latrines will need servicing per year, at an approximate cost (in 2009 Rands) of R600 million Rand per year.

Waterborne sanitation is more popular with users and politicians, but there is a cost. While it is possible to build the on-site structure and the sewer connection and local reticulation for not much more than a VIP latrine (R7 000 to R9 000 per site is a reasonable budget figure), the additional costs of bulk water and bulk sewer provision and the costs of waste water treatment can increase the real cost of waterborne sanitation to well over R30 000 per site.

The cost of operating and maintaining waterborne sanitation is not less than R40 per family per month, but depending on water costs and water-use efficiency it can easily be five times as much. In the case of poor families, and half the population in many South African towns and cities are poor, the chances are that this cost will be fully carried by the municipality. If a municipality is unable or unwilling to budget to maintain fully waterborne systems, then it must rather limit itself to dry or semi-dry sanitation systems.

Urine diversion type toilets have proven successful in some cases, but not all. They have two important selling points: the first is that they can be relatively easily managed and maintained by the users themselves; the second is that they allow the users to capture a waste product (urine) which has great value as a liquid fertilizer. However, it was observed in the case studies forming part of this report that this type of sanitation performs particularly poorly in communal settings, and in settings where there has not been acceptance by the users of their role in the maintenance of the system.

Over the years a number of aids have been produced to assist planners with the decision-making process required to choose an appropriate basic sanitation option for a given area. These include the *Site Sanitation Planning and Reporting Aid* (SSPRA) produced by Howard et al., 2000, the Norad/DWAF *Decision Making Framework for Municipalities* produced by Holden et al., 2005, and DWAF's *Groundwater Protocol*. There is a need for a software tool that works with the user interactively to progressively eliminate unsuitable sanitation options by asking appropriate questions. There is also a need to combine much of the information required for decision making into one instrument (for example, what is a soil percolation test and how is it carried out?). The *Which San?*[3] programme has been developed under the aegis of this project to go some way towards realising that goal.

[3] Available from the WRC Website (www.wrc.org.za/software/whichsan) or from contact@pid.co.za.

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Mr MVG White	Development Cooperation Ireland

TABLE OF CONTENTS

Appendix A:
Detailed drawings and cost sheets for three basic on-site sanitation options:

- Single Pit VIP
- Double Pit VIP and
- Single Pit Urine Diversion

Appendix B:
Tables extracted from the report
The new Local Government Equitable Share Formula and its Impact on Water Services
by Derek Hazelton

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

South Africa's Department of Water Affairs and Forestry (DWAF) uses the slogan "Water is life. Sanitation is dignity" to promote its drive to provide universal coverage of water and sanitation to all. In fact both improved water supply and sanitation are known to be key requirements in the drive to achieve improved public health. In a survey of 11 000 readers conducted by the British Medical Journal in January 2007, improvements in sanitation were voted as the most significant cause of public health improvements in modern times, narrowly edging out antibiotics and anaesthesia (British Medical Journal, 2007).

1.1 The Millenium Development Goal

At the World Summit on Sustainable Development in 2002 the importance of sanitation was recognised when the target *to halve, by 2015, the proportion of people without access to basic sanitation* was added to the Millennium Development Goals (Evans, 2005).[4] In 2004 the World Health Organization and UNICEF's Joint Monitoring Programme for Water Supply and Sanitation released their midterm assessment of progress, which showed that during the period 1990 to 2002 world sanitation coverage had improved from 49% to 58%. The MDG target implies that sanitation coverage must be above 79% by 2015. With the world population increasing all the time, realisation of the target will require the rate of sanitation delivery to double from 80 million to over 160 million people per annum.

Table 1: WHO/Unicef Estimates of World Sanitation Backlogs (WHO/Unicef 2004)

World Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	5,263,484	2,263,298	43	3,000,186	57	475,293	21	2,250,139	75	2,684,377	51
2002	6,224,874	2,987,940	48	3,236,934	52	567,709	19	2,039,269	63	2,614,447	42

In Table 1 above it can be seen that although the total percentage sanitation backlog decreased 9% during the period 1990 to 2002 (from 51% to 42%), with a billion people having meanwhile been added to the world's population, the backlog number remained essentially unchanged at 2.6 billion.

[4] The Millennium Development Goals (MDGs) are a set of targets to extend the benefits of development to a substantially increased proportion of the world's poor.

1.2 South Africa's progress with the elimination of the sanitation backlog

In 2003 South Africa adopted the Strategic Framework for Water Services (SFWS), which, inter alia, included 19 specific performance targets. Of the 19, the second target is to completely eliminate South Africa's sanitation backlog by 2010. The Monitoring and Evaluation Unit of the Department of Water Affairs and Forestry produces a quarterly "Consolidated Water Sector Report" under the aegis of the Masibambane programme. In the report for the quarter ended March 2007 the sanitation backlog is estimated at 3 439 544 homes, down from an estimated 4 759 709 at the time of the 2001 Census. At this rate South Africa appears to be well on track to meet the MDG sanitation goal (to halve the 2002 backlog by 2015).

1.3 Purpose and structure of this report

From the above it is clear that sanitation is enjoying much deserved priority at both international and national levels. With so much work still to be done to provide decent and functional sanitation for all, it is appropriate to stand back and assess the work that has been done on sanitation improvement since the early 1990s. The purpose of this study has been to investigate whether the improvements made are working, and whether they are financially sustainable. In its coverage the study is biased towards rural sanitation, as the overwhelming majority of South Africans without proper sanitation live in rural areas.

A further purpose of this report is to introduce the ***Which San?*** sanitation decision support tool. ***Which San?*** has been developed in order to answer two questions for a given planning scenario:

- What sanitation options will be technically feasible in an area?
- What sanitation options will be financially feasible in an area?

Report structure

Section 2 reviews sanitation in five Southern African countries, namely Botswana, Lesotho, Malawi, Swaziland and Zimbabwe. Section 3 deals with sanitation policy and experience in South Africa, and includes the results of a recent survey of over 1000 people, half of whom have had sanitation improvements and half not. Section 4 describes the findings of 18 South African sanitation case studies, covering a range of sanitation types and experiences good and bad. Section 5 reviews the lessons learned from the case studies, while Section 6 deals with the question of pit latrine emptying. Section 7 reviews the financing of sanitation in South Africa, and Section 8 discusses the planning of sanitation options. This is followed by Section 9, Conclusions and Recommendations.

1.4 Definitions

Since the Water Supply and Sanitation Policy White Paper was published in November 1994 several definitions regarding sanitation have been developed. The definitions given by the Department of Water Affairs and Forestry are:

Basic sanitation facility – *the infrastructure necessary to provide a sanitation facility which is safe, reliable, private, protected from the weather and ventilated, keeps smells to the minimum, is easy to keep clean, minimises the risk of the spread of sanitation related diseases by facilitating the appropriate control of disease carrying flies and pests, and enables safe and appropriate treatment and/or removal of human waste and waste water in an environmentally sound manner* (DWAF, 2003; p. 45).

Basic sanitation service – *the provision of a basic sanitation service facility which is easily accessible to a household, the sustainable operation of the facility, including the safe removal of human waste and wastewater from the premises where this is appropriate and necessary, and the communication of good sanitation, hygiene and related practices* (DWAF, 2003; p. 45).

Sanitation services – *the collection, removal, disposal or treatment of human excreta and domestic wastewater, and the collection, treatment and disposal of industrial wastewater. This includes all the organisational arrangements necessary to ensure the provision of sanitation services including, amongst others, appropriate health, hygiene and sanitation related awareness, the measurement of the quality and quantity of discharges where appropriate, and the associated billing, collection of revenue and consumer care. Water services authorities have a right but not an obligation to accept industrial wastewater from industries within their area of jurisdiction* (DWAF, 2003; p. 65).

1.5 Types of Sanitation

1.5.1 VIP Latrines (and derivatives)

The VIP latrine is similar to a conventional pit latrine, but includes a vertical ventilation pipe beside or within the latrine superstructure. Two problems encountered with a standard pit latrine are odours and the presence of flies. The design of the VIP latrine largely eradicates these problems as air flows down into the latrine pit through the latrine squat hole and up out of the ventilation pipe, thus removing odours from the latrine. The fundamentals of VIP operation is shown in Figure 1. Flies are attracted by the smell from latrines, but in a VIP latrine they are attracted to the top of the vent-pipe rather than to the latrine squat hole.

There is a fixed screen across the top of the vent pipe which prevents flies from entering the pipe.

Sludge accumulation rates in pit latrines are dependent on a variety of factors, the most important of which are the number of users, the degree to which the pit or tank is drained, and the degree to which the pit is used for disposal of other household waste. In practice sludge accumulation rates vary from as little as 10 litres per user per year to as much as 100 litres per user per year, with the median rate being in the 25 to 30 litre range (Still, 2002).

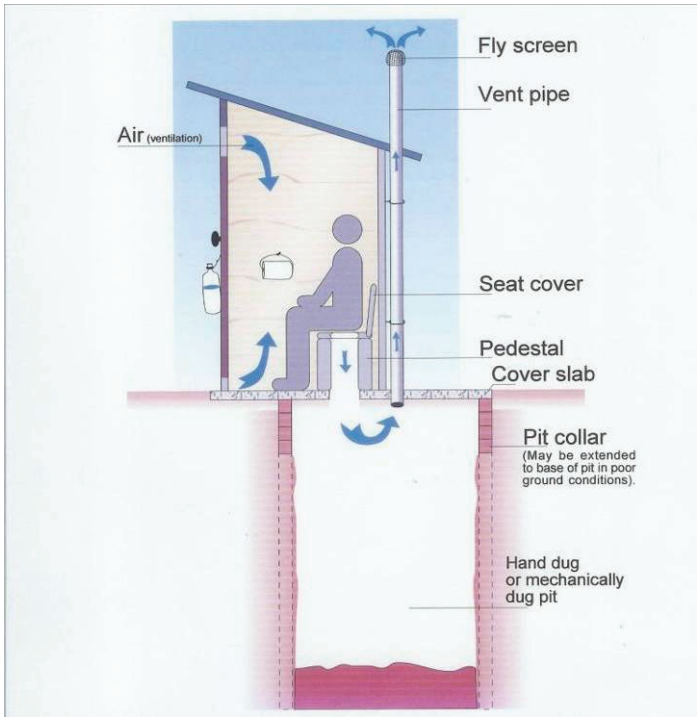

Figure 1: Ventilated Improved Pit Latrine Schematic
(from the DWAF publication, Sanitation Technology Options, 2002)

1.5.2 Ecological Sanitation

Ecological sanitation can be viewed as a three-step process dealing with human excreta: containment, sanitisation and recycling. The objective is to protect human health and the environment while reducing the use of water in sanitation systems and recycling nutrients to help reduce the need for artificial fertilizers in agriculture (Winblad *et al.*, 2004).

An example of an ecological sanitation option is the urine diversion toilet which separates the urine and faeces at source. The solid faecal matter is collected in a vault where it dehydrates, while wood ash or soil and ash is often added to assist in the dehydration and composting process (Morgan, 2005). [Note: if the faecal waste is to be used for soil conditioning the addition of ash is not advisable]

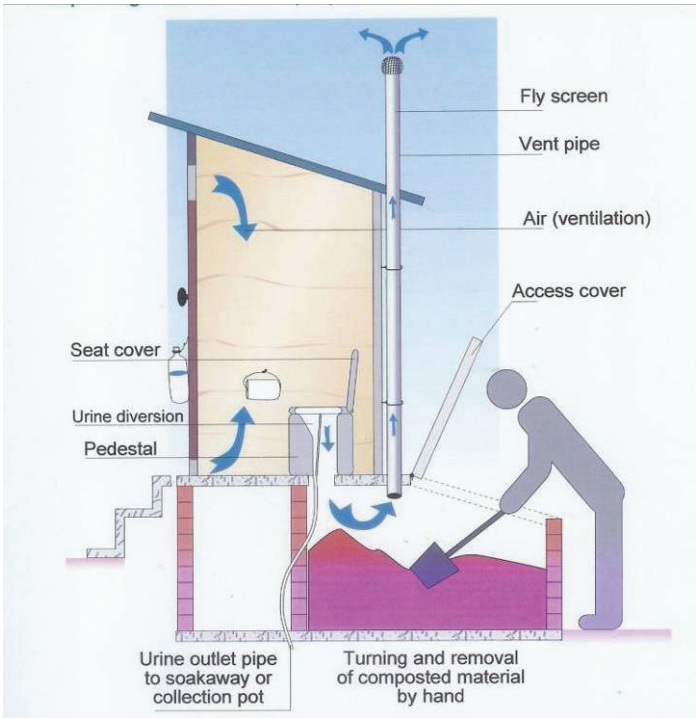

Figure 2: Urine Diversion Toilet schematic
(from the DWAF publication, Sanitation Technology Options, 2002)

1.5.3 On-site water-borne sanitation

Waterborne sanitation consists of those systems that remove faeces from the toilet using water. In rural and peri-urban areas where there is no municipal sewer network and sewage treatment facility, the waste is piped to a septic tank, a conservancy tank, or a small package wastewater treatment plant. After leaving the septic tank or small plant, the water is generally disposed of in a seepage bed or soakpit.

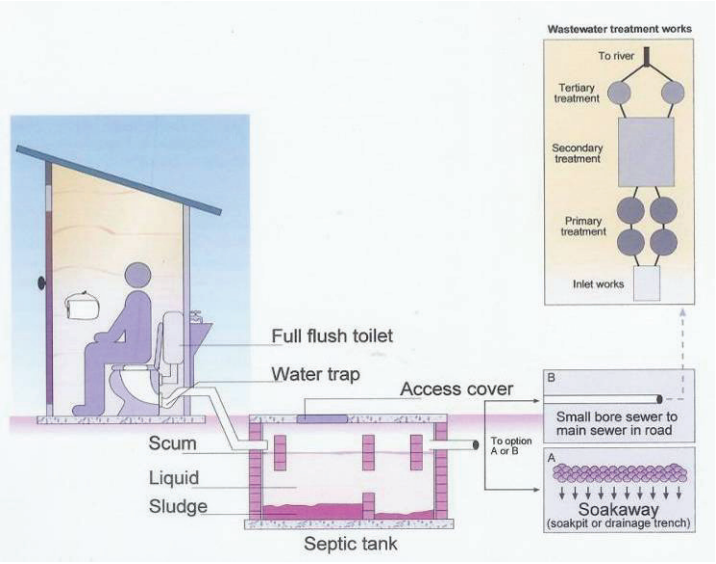

Figure 3: On-site waterborne sanitation schematic
(from the DWAF publication, Sanitation Technology Options, 2002)

1.5.4 Fully water-borne sanitation (with off site treatment)

In urban areas the standard sanitation system is full water-borne sanitation. From a toilet, which typically uses between 6 and 12 litres to flush, the water is carried down the sewer network to a municipal wastewater treatment works. The cost of this sanitation option is thus determined by the cost not just of the toilet, but also by the cost of constructing, operating and maintaining the sewage disposal infrastructure.

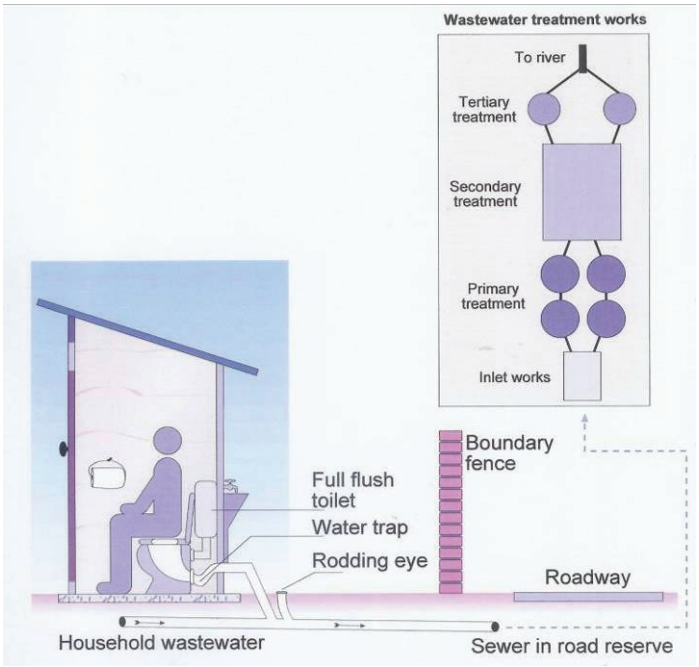

Figure 4: Schematic for Fully Waterborne Sanitation
(from the DWAF publication, Sanitation Technology Options, 2002)

Simplified sewerage or shallow sewerage is a variation on conventional sewerage in that smaller pipe diameters are used, in conjunction with flatter pipe gradients and shallower pipe depths (Mara, 2002). These economies are possible because conventional sewerage systems are typically designed using overly conservative design factors which are not well understood by the responsible engineers. A further economy can be achieved if the sewers are laid mid-block between houses, rather than in the road. Simplified sewerage is particularly suitable for the upgrading of existing unplanned low-income areas, but can also be used for housing estates of any income level.

1.5.5 Other sanitation options

The above four options are the main divisions applicable in the South African context. However, there are other types of sanitation, variations on the above, which do also play a role, either in South Africa or elsewhere in the world.

Firstly the Ventilated Improved Double Pit latrine (or VIDP, see Figure 5) is essentially a VIP (see Figure 1) except that two pits are used instead of one. Only one pit is used at a time,

so after the first pit is full the contents can be left to decompose and dry out while the second pit is in use. When the second pit is full, the contents of the first can be emptied more easily than is the case with a single pit VIP. The VIDP is particularly appropriate where the soil depth is shallow or the ground water table is high, making it impossible to dig a normal sized pit.

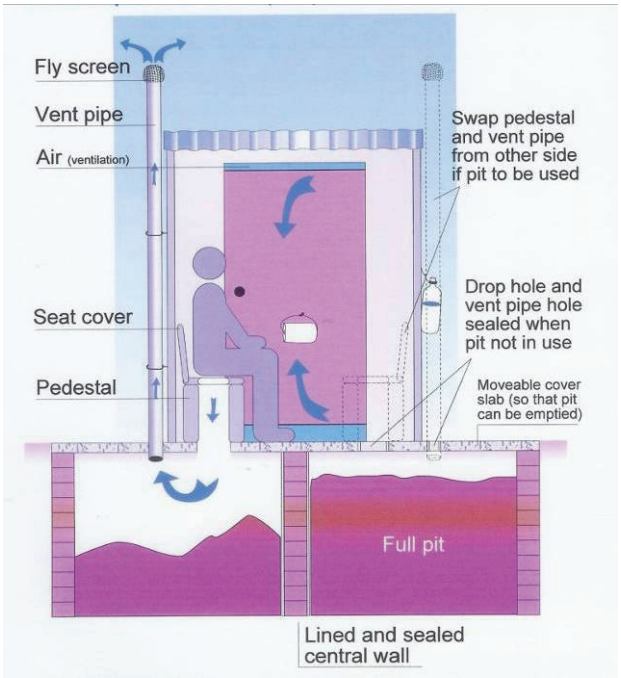

Figure 5: Schematic for Ventilated Improved Double Pit Sanitation (VIDP)
(from the DWAF publication, Sanitation Technology Options, 2002)

The pour flush latrine (See Figure 6) is not well known in South Africa, but is widely used in Asia, where water, and not paper, is commonly used for anal cleansing. The wash water, which is just a few litres (much less than the full flush toilets used with full waterborne systems), is used to transport the waste to a pit which is constructed at some distance from the latrine itself. The pour flush latrine pit acts like a septic tank and soakpit combination, with the excess water seeping out through the walls. Like VIPs, pour flush latrines can be constructed with double pits so that one pit can be allowed to settle and dry out for emptying while the other is used.

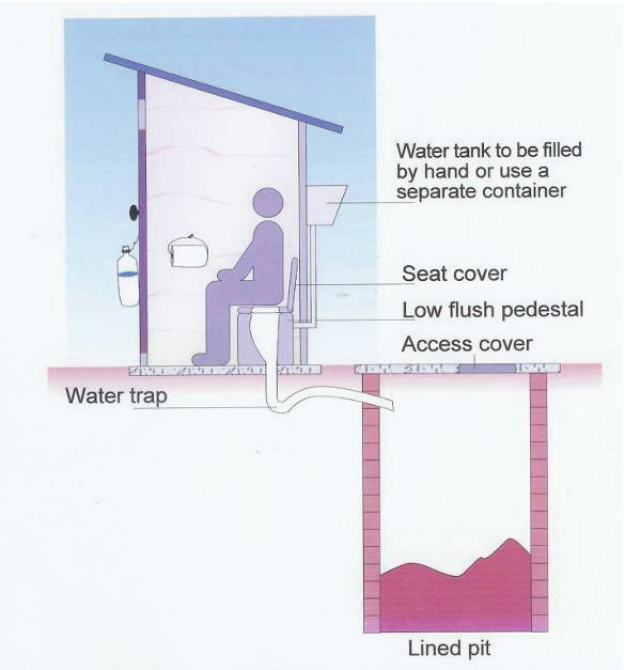

Figure 6: Schematic for Pour Flush Latrine
(from the DWAF publication, Sanitation Technology Options, 2002)

Another sanitation system which requires mention is the aqua privy, which is a form a simple septic tank arrangement where the toilet is built directly over the tank so that no flush water is needed. This was used extensively in low income housing developments in the SADC region in the past but has gone out of fashion. The aqua privy fell out of favour possibly because it is clearly not as attractive to users as a full waterborne flushing system, and because if the tanks leaked (as they often did) the tank required constant topping up to maintain the water seal.

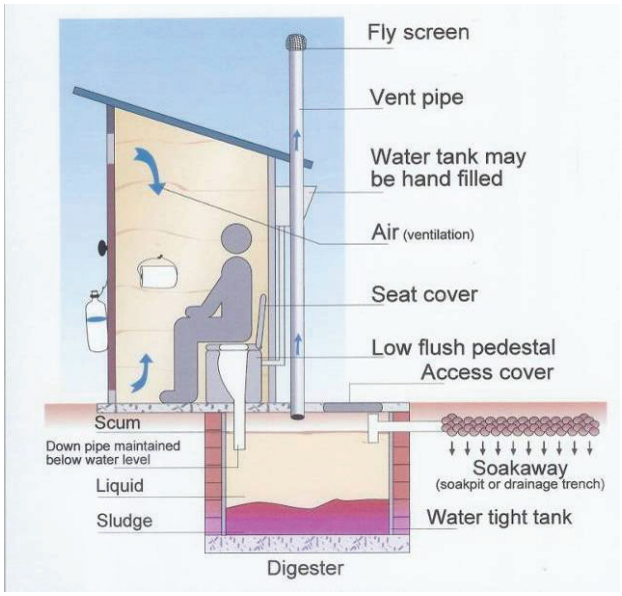

Figure 7: Schematic for Aqua Privy
(from the DWAF publication, Sanitation Technology Options, 2002)

Finally a conservancy tank is a sealed vault which receives waste but does not allow seepage or overflow to the surrounding soil or a soakpit. Depending on how much or little flush water is used and the size of the tank, conservancy tanks typically fill up in weeks or months, and then need to be pumped out using a vacuum tanker. They are therefore a high maintenance and expensive form of sanitation. Sometimes, more often than should be the case, pit latrines are lined in such a way that very little or no seepage is allowed through the walls (this will be the case if the lining is made using ferrocement, with no drainage holes, or using bricks or blocks, with all joints mortared).

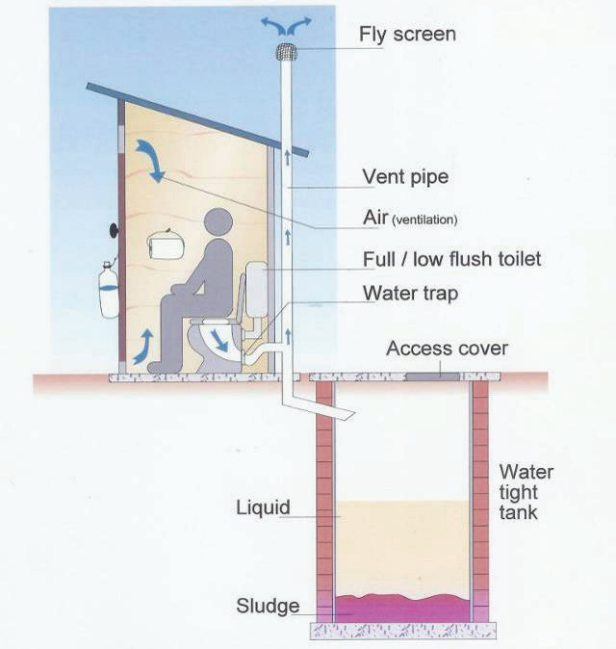

Figure 8: Schematic for Conservancy Tank
(from the DWAF publication, Sanitation Technology Options, 2002)

2. SANITATION PROGRAMMES IN SOUTHERN AFRICA

The WHO/UNICEF Joint Monitoring Programme gathers information on the access that people have to water and sanitation in developing countries. Characteristics have been identified of those countries that are 'on track' to achieve the millennium development goals and those that are 'off-track'.

Characteristics of 'off-track' countries include:

- External support agencies drive water and sanitation sector activities
- NGOs provide services yet coordination is weak and programmes are off-budget
- A good diagnosis of water linkages at a central level, but a poorer understanding at decentralised levels
- Water tends to be a high priority, though in practice, sufficient governance to implement policies is weak (DFID, 2005).

Characteristics of 'on-track' countries include:

- Government drives water and sanitation sector reform
- Government expresses the linkages between water, poverty and economic development in high-level policy frameworks
- NGOs act as effective supporters, and help to drive water as a policy issue.
- There is active implementation of the policies relating to water and sanitation sector reform
- Issues of effective decentralisation are weak relative to the other water sector governance factors (DFID, 2005).

In Sections 2.1-2.5 the national sanitation programmes of Botswana, Lesotho, Malawi, Swaziland and Zimbabwe are described. The programmes were initiated before the formulation of the Millennium Development Goals.

2.1 Botswana

The government of Botswana began subsidising on-site sanitation in rural areas in 1980, prior to this, the government was only subsidising low-cost sanitation in urban areas. The National Rural Sanitation Programme used the VIP latrine as the solution to implementing basic sanitation in rural areas.

The National Rural Sanitation Programme in Botswana was implemented by District Councils who controlled a tendering procedure and appointed contractors to construct the toilets. Individual householders provided minimal assistance in the process. It was found that that the contractor-based delivery system prohibited large scale delivery of the latrines and made the programme unaffordable without substantial subsidies. Health and user education was tackled in the following four ways:

- Talks at community gatherings when programmes are launched
- Follow-up talks at community gathering with occasional home visits and talks at clinics
- Talks at demonstration latrine sites
- Periodic workshop for health inspectors and other council health department staff.

At 2008 prices, the cost of a latrine constructed in the Botswana programme including health education was R5 525 for council based delivery and R5 131 for contractor based delivery. The 2008 figures have been obtained by escalating from the September 1994 figures using inflation indices from Stats SA. The Botswana government subsidised the latrines at an average of 70% of the costs.

According to the 2004 WHO and Unicef joint monitoring programme report, Botswana reduced its overall sanitation backlog percentage from 62 to 59 over the period 1990 to 2002. However, due to population growth, the number of people without sanitation during this period *increased* from 839 000 to 1 044 000. During the period under review the number of people served grew by an average of 18 000 per year.

Table 2: Progress made in reducing the sanitation backlog in Botswana 1990-2002

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	1,354	569	42	785	58	222	39	620	79	839	62
2002	1,770	903	51	867	49	388	43	650	75	1,044	59

adapted from Unicef/WHO (2004)

2.2 Lesotho

Lesotho's National Rural Sanitation Program began in 1983 as a single district pilot project and gradually expanded into a nationwide improvement program (Evans *et al*., 1990). From the beginning the Lesotho sanitation program adopted the VIP latrine technology and

adapted it to local conditions, construction techniques and preferences (Pearson, 2002). A distinctive aspect of the Lesotho sanitation programme is that the latrines were built at the users' cost i.e. there were no subsidies provided. However, the programme did provide credit to households for investment in VIP latrines, which were built by private sector contractors. In order to receive credit, households had to first dig a pit and provide a deposit of 30-40% of the total cost. Loans were typically in the range US$50-300 (Saywell, 1998). The Lesotho Bank administered the loans, the money for which originated with the government.

Blackett (1994) attributed the success of the national sanitation program in Lesotho to the following factors:

- A standardized latrine which was affordable and acceptable for most people
- Householders financing the latrine themselves or through a credit mechanism (minimal direct subsidy)
- Promotion of the VIP latrine coupled with health and hygiene education
- Incorporation of the management of the programme into existing government structures.

Blackett (1994) continues that grants or free latrines were generally considered inappropriate for domestic sanitation in Lesotho because:

- They are very difficult to target and rarely assist those who have genuine need of help
- In several counties, while creating short-term benefits subsidies have also created serious problems that affect the long-term sustainability of what might other have been an effective program
- They intrinsically contradict the policy of sustainability
- Users have less than full responsibility for their sanitation, and, therefore, proper maintenance was considered less likely
- They place a permanent drain on government or donor resources.

With regard to the credit scheme run by the Lesotho Bank, Saywell (1998), comments that the credit scheme, i.e. repayment with interest, was intended to ensure that households accepted full responsibility for sanitation. Administration costs for the loan proved to be high compared to their size and additional costs like the promotion and management of the scheme were not charged to the borrower putting a question mark over its long term

sustainability. The project was successful at promoting sanitation but it did not create a sustainable micro-finance institution (Saywell, 1998). In the urban areas approximately 10% of households cannot afford a VIP latrine without some form of subsidy. By following a zero subsidy approach, the government programme has not yet met the needs of the poorest people, even if the majority of households have been able to build latrines (Pearson, 2002).

According to Palesa Mafosi, Lesotho's national sanitation co-ordinator, Lesotho has since the '80s improved its sanitation coverage from 15 percent to 48 percent in rural areas and from 22 percent to 82 percent in urban areas with, 144 000 latrines being constructed (IRIN, 2004). However the WHO and Unicef joint monitoring programme, which applies a rigorous and standard methodology, reports different figures for sanitation coverage in Lesotho. According to their 2004 report Lesotho's backlog percentage remained static during the period 1990 to 2002 at 63%. However, due to population growth, the number of people without sanitation during this period *increased* from 989 000 to 1 134 000. During the period under review the number of people served grew by an average of 7 000 per year.

Table 3: Progress made in reducing the sanitation backlog in Lesotho 1990-2002

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	1,570	267	17	1,303	83	104	39	886	68	989	63
2002	1,800	324	18	1,476	82	126	39	1,004	68	1,134	63

adapted from Unicef/WHO (2004)

2.3 Malawi

Malawi's Peri-Urban and Rural Sanitation Programme began in the early 1980's with the implementing institutions of the programme being a combination of the Malawian government's Ministry of Works and Supplies together with a Technology Advisory Group from the World Bank.

The technology choice for the programme was the VIP latrine. However, the cost of latrine was not affordable without a substantial subsidy. The alternative technology offered in the sanitation programme was the Sanplat, which is a concrete squatting slab.

A number of depots were established in large towns and key rural areas where prefabricated sanitation components were provided on a cost recovery basis. These were also training centres for project staff, local contractors and self help builders (Mvula Trust, 1994).

Community participation was achieved through adding a health education and sanitation promotion component to an existing programme set up for construction and maintenance of gravity fed water supplies.

The initial cost of production of the Sanplats had a substantial subsidy so that the community paid only for the cost of materials. The cost of production and support of the programme was borne by the Malawian government, the United Nations Development Programme and the World Bank (Mvula Trust, 1994).

According to the 2004 WHO and Unicef joint monitoring programme report, Malawi reduced its overall sanitation backlog percentage from 64 to 54 over the period 1990 to 2002. However, due to population growth, the number of people without sanitation during this period *increased* from 6 052 000 to 6 410 000. During the period under review the number of people served grew by an average of 171 000 per year.

Table 4: Progress made in reducing the sanitation backlog in Malawi 1990-2002

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	9,456	1,135	12	8,321	88	545	48	5,492	66	6,052	64
2002	11,871	1,899	16	9,972	84	646	34	5,784	58	6,410	54

adapted from Unicef/WHO (2004

2.4 Swaziland

The most common forms of sanitation in the rural areas of Swaziland are the bush and traditional pit latrines. Minimum sanitation coverage in terms of the government of Swaziland's policy is a VIP latrine. However, most of the current and past sanitation coverage figures include areas where traditional pit latrines are used, and consequently the coverage figures reported by various sources are exaggerated. The extent of rural sanitation coverage in Swaziland is shown in Table 5.

Projected figures show that total sanitation coverage (i.e. VIP or better) in rural areas in Swaziland is expected by 2022, subject to the availability of sufficient funding (Mwendera, 2005). The estimated cost of sanitation and water supply in rural areas in Swaziland is given in Table 6. The cost per VIP (in 2003) was about R2 000 and the Swazi government was then providing subsidies to the value of R600 per latrine. Each toilet serves a homestead, which on average has 10 persons.

Table 5: Rural sanitation coverage trends in Swaziland (* denotes projected value), after Mwendera (2005)

Year	Rural sanitation coverage (%)
1980	19.0
1986	25.0
1991	28.0
1996	36.4
2000	44.0
2002	45.0
2003	61.0
2004	63.0
2005	66.0*
2010	75.0*
2015	90.0*
2022	100.0*

Table 6: Cost (2003 Rands) of providing new water supply and sanitation services in rural areas in Swaziland (after Mwendera, 2005)

Service	Level of service	Unit cost (R)	Number of people served per system	Cost per capita (R)
Water supply scheme	Macro-scheme	2 000 000	2 000	1 000
	Micro-scheme	100 000	250	400
Sanitation	VIP with government subsidies	600 (actual cost of latrine R2000)	10	60

NOTE: To convert 2003 sanitation costs to 2008 Rands adjust by 50%.

The 2004 WHO and Unicef joint monitoring programme report does not have sanitation coverage figures for Swaziland for 1990. As at 2002, the sanitation backlog was estimated at 513 000 people, or 48% of the total population. Mwendera (2005) reports that 14 000 rural VIPs were either completed or under construction in fiscal year 2003/2004, at a time when the estimated rural sanitation backlog is 461 000.

Table 7: The sanitation backlog in Swaziland in 2002

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	847	195	23	652	77						
2002	1,069	246	23	823	77	54	22	461	56	513	48

adapted from Unicef/WHO (2004)

2.5 Zimbabwe

Zimbabwe's Integrated Rural Water Supply and Sanitation Programme (IRWSSP) was initiated in the mid-1980s with the objective of providing the entire population of Zimbabwe's communal and resettlement areas with access to safe and adequate water and sanitation facilities by the year 2005. This meant that 35 000 primary water supply systems and 1.4 million VIP latrines had to be constructed (Robinson, 2002). These main objectives have not been met even with extensive investment and 18 years of implementation. However, it is estimated that there are now over 500 000 VIP latrines in Zimbabwe (Robinson, 2002).

The approach taken by the IRWSSP involved:

- Promotion of health and hygiene education
- Participation of user communities
- Provision of water and sanitation facilities
- Establishment of operation and maintenance systems
- Transfer of technical and organisational skills (Robinson, 2002)

The IRWSSP was a supply driven approach and was funded initially by external support agencies and the Zimbabwean government. The initial arrangement was for the funding by external support agencies to be phased out and the funding from the Government of Zimbabwe to increase. However, the Zimbabwean economy experienced increasing difficulties from the early 1990s and the percentage of funding for the IRWSSP from external sources increased, instead of decreasing as planned (see Table 8).

The high dependency on external aid affects operation and maintenance for the following reasons: the majority of funders required their funding to be spent on capital investment; the Zimbabwean government did not allocate sufficient funds to operation and maintenance; and there was little political support for cost recovery. External funding by the end of the 1990 was aimed at supporting local NGOs that were implementing low cost household

technologies and hygiene programmes at a much lower cost than the IRWSSP was able to (Robinson, 2002).

Table 8: External Agency Funding of IRWSSP in Zimbabwe (after Robinson, 2002)

Year	Planned External Support Agency Funding (%)	Actual External Support Agency Sector Funding (%)
1985	60	35
1990	55	90
2000	40	95

According to the 2004 WHO and Unicef joint monitoring programme report, Zimbabwe reduced its overall sanitation backlog percentage from 51% to 43% over the period 1990 to 2002. However, due to population growth, the number of people without sanitation during this period *increased* from 5 338 000 to 5 519 000. During the period under review the number of people served grew by an average of 182 000 per year.

Table 9: Progress made in reducing the sanitation backlog in Zimbabwe 1990-2002

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	10,467	3,035	29	7,432	71	941	31	4,459	60	5,338	51
2002	12,835	4,364	34	8,471	66	1,353	31	4,151	49	5,519	43

adapted from Unicef/WHO (2004

2.6 Summary

Botswana, Malawi, Lesotho, Swaziland and Zimbabwe's have adopted a variety of approaches to sanitation. In Malawi a low cost approach based on the provision of "sanplats" (precast pit cover slabs) has been used, whereas in the other countries more substantial structures have been used. In each of these countries, except Lesotho, sanitation has been incorporated into subsidised programmes, although the level of subsidy varies substantially from very low (Zimbabwe and Malawi) to moderate (Swaziland) to high (Botswana). Lesotho adopted a no subsidy approach, with sanitation encouraged through training, marketing and ready access to cheap loan capital.

In these countries the current estimated sanitation backlog percentages vary in the 40 to 60% range. Although backlog percentages are decreasing with time, the current rates of delivery are not fast enough to keep up with population growth, so that in absolute terms the

numbers of people without access to sanitation in each of these countries is increasing. Table 10 below summarizes the data.

Table 10: Summary of Sanitation Provision in Five SADC Countries (1990-2002)

	Population in 2002	Estimated backlog in 1990	Estimated backlog in 2002	Average rate of provision 1990-2002	Estimated Backlog % in 1990	Estimated Backlog % in 2002
Botswana	1,770,000	839,000	1,044,000	18,000	62	59
Lesotho	1,800,000	989,000	1,134,000	7,000	63	63
Malawi	11,871,000	6,052,000	6,410,000	171,000	64	54
Swaziland	1,069,000		513,000	14,000		48
Zimbabwe	12,835,000	5,338,000	5,519,000	182,000	51	43

3. PROVISION OF BASIC SANITATION IN SOUTH AFRICA

In 1994, the new government of South Africa made the Department of Water Affairs and Forestry (DWAF) responsible for ensuring that all South Africans had equitable access to water supply and sanitation. DWAF consulted a range of interested parties and produced a policy outlined in a government White Paper (Muller, 2002). The Water Supply and Sanitation White Paper was published in November 1994 and focused on the establishment of a new national water services function and on the role of national government in assuming a direct delivery function to provide a basic water and sanitation service rapidly to people living primarily in rural areas. Since 1994 the White Paper on Basic Household Sanitation (2001) and the Strategic Framework for Water Services (2003) have been approved by government and outline government policy in the water services sector. These policy documents are summarised in Sections 3.1 and 3.2 below.

3.1 White Paper on Basic Household Sanitation September 2001

3.1.1 Purpose of Sanitation White Paper

The purpose of Basic Household Sanitation legislation is to fulfil the South African Government's constitutional responsibility to ensure that all South African have access to adequate sanitation. In 2001 when the White paper was published it was estimated that 18 million South Africans did not have access to adequate sanitation (in 2008 the figure was reported by DWAF to have been reduced to 12 million, DWAF 2008).

The 2001 Sanitation White Paper focused on alleviating the following negative effects of poor sanitation:

- public health problems
- environmental impacts and contamination
- economic impact of poor sanitation, and
- social and psychological problems.

Over the last decade there have been considerable investments in the provision of safe water supplies for all, but the health benefit of this investment is reduced when there is limited investment in sanitation and health and hygiene promotion. Sanitation programmes can have these dramatic health benefits because many of the pathogens are spread from hand to mouth or from hand to food to mouth rather than through drinking contaminated water.

The twelve policy principles stated in the 2001 White Paper which are used to address the sanitation problem are:

- Sanitation improvement must be demand responsive and supported by an intensive Health and Hygiene Programme
- Community participation is essential
- Sanitation must be integrated with the IDP process
- Sanitation is about environment and health
- Basic sanitation is a human right
- The provision of access to sanitation services is a local government responsibility
- "Health for All" rather than “all for some” – i.e. costs must be sustainable
- There must be equitable regional allocation of development resources
- Water has an economic value
- The Polluter Pays Principle must be used
- Sanitation services must be financially sustainable
- Environmental integrity must be protected

3.1.2 Sources of funding for sanitation improvement

The sources of funding available to a municipality that are listed in the 2001 White Paper include:

- The equitable share subsidy
- Infrastructure grants
- The municipality’s own revenue.

The Equitable Share is defined as the sum of unconditional transfers flowing from national to local government. The Equitable Share was introduced to allow the local government sector to overcome the burden of service delivery to the very poor and is calculated so that the operating cost of basic services can be covered. However, the Constitution indicates that intergovernmental transfers like the Equitable Share cannot be conditional, which means that municipalities may use the subsidy for other purposes (and often do). In a case where the cost of delivering the service should exceed the amount that is billed to very poor households, it is envisaged that the subsidy will be used to contribute towards the general operating account of the municipality. In reality most poor families in South Africa do not pay for municipal services.

Infrastructure grants for public investment programmes have been plagued by co-ordination and communication problems. The communities that should benefit from such grants often

complain of complain of a weak link between their priorities and the programme, which are often linked to clearing the budget before the financial year-end. This problem highlights that municipalities must have effective control over their resources. The municipal infrastructure investment framework (MIIF) has been formulated to respond to this type of issue. It emphasises the need for a closer linkage between the fiscal changes and the other policy initiatives.

Funding for all types of residential infrastructure is now routed through a single, integrated grant known as the Municipal Infrastructure Grant (MIG), rather than the separate sector specific channels through different national departments under the previous system. The single grant is distributed between municipalities through a formula mechanism that generates three-year allocations for individual municipalities. Existing financial obligations to projects already in progress will be honoured and National Departments will be given a period of at least three years to complete the ongoing municipal infrastructure projects.

The Department of Water Affairs and Forestry originally provided a sanitation subsidy. In the 2001 Household Sanitation White Paper this was divided into R600 for community development and R600 for the basic toilet structure – i.e. the total subsidy was then R1200 (the total has since increased to R6 000, and is now administered through the MIG fund). There may continue to be a need for dedicated funding for specific projects and programmes, for example, the demonstration of low cost sanitation interventions.

The implications of this rationalised funding approach for meeting the sanitation backlog are:

- municipalities will drive the implementation programmes
- infrastructure transfers to municipalities will be efficient
- infrastructure transfers to municipalities will be predictable (for a three year window which is sufficient for most contracts with private sector contractors)
- municipalities will be responsible for allocating the funds between infrastructure projects and will thus be empowered to prioritise
- municipalities will be fully accountable within nationally prescribed norms and standards and cannot decide not to accept transfer of the infrastructure once the construction has been completed.

For those municipalities which incorporate rural areas, i.e. those areas that generally have the greatest sanitation need, the subsidisation of poor households by rich households is an important policy principle, and is used with some effect in urban areas with stepped water

tariffs. However, the greater part of the costs of servicing the poor is still met by intergovernmental transfers.

The Minister of Water Affairs and Forestry under Section 10 of the Water Services Act (1997) prescribed norms and standards for tariffs for water services. The Minister prescribed that a tariff set by a water services institution for the provision of sanitation services to a household must:

- support the viability and sustainability of sanitation services to the poor;
- recognise the significant public benefit of efficient and sustainable sanitation services
- discourage practices that may degrade the natural environment.

3.2 Strategic Framework for Water Services 2003

The Strategic Framework for Water Services published in September 2003 sets out the national framework for water supply and sanitation. The purpose of the Strategic Framework is to put forward the vision for the water service sector for the next ten years and to set out the framework to achieve this. It addresses the full spectrum of water supply and sanitation services and all relevant institutions. The White Paper on Basic Household Sanitation (2001), which focuses specifically on basic sanitation services, has been amended where necessary to ensure full compatibility with the Strategic Framework. This Strategic Framework updates the 1994 Water Supply and Sanitation White Paper.

Key changes in the strategic framework for water services compared with the 1994 White Paper are:

- The Strategic Framework is a comprehensive paper for the water services sector
- DWAF will become a sector leader, supporter and regulator (rather than an operator or implementer of water supply services)
- Water Services Authorities are responsible for the delivery of water services
- An approach to the institutional reform of water services is set out
- The financial policy framework reflects the consolidation of national government funding to local government through the equitable share, the municipal infrastructure grant and the capacity building grant
- There is more emphasis on sustainability, financial viability and efficiency
- The vision of the water ladder is clearly defined in order to ensure commitment of the sector to enable all people to progressively move up the ladder to higher levels of service.

The local government elections in 2000 began the final stage in the local government transformation process that commenced in 1993. After 2000 local municipalities assumed full responsibility for ensuring water and sanitation services as provided for in the Constitution of RSA. DWAF had previously been used as the department through which funding for water services was directed. Since 2000, government funding for water services has increasingly shifted to consolidated grant mechanisms directed through local government.

A major emphasis included in the Strategic Framework is the provision of **free basic sanitation**. The purpose of the free basic sanitation policy is to assist in promoting affordable access by poor households to at least a basic level of sanitation service. In providing free basic sanitation the provider must consider infrastructure provision, health and hygiene promotion and the operating and maintenance costs.

The definition of a basic sanitation service (Section 1.4) does not define the technology to be used in providing such a service. The technology choice, which is made by the water services authority, is the key to success in providing free basic sanitation services in a sustainable manner. In urban areas where many businesses are located and residential densities are high the Strategic Framework for Water Services states that waterborne sanitation is usually the most suitable technical solution and should be regarded as a basic level of service for the purposes of free basic sanitation policy. In rural areas where housing densities are low and few businesses are located, on-site solutions are an appropriate basic level of service. It is the responsibility of the water services authority to make sure that the water services provider will be able to operate and maintain the sanitation system within funding limits.

The Strategic Framework outlines that subsidies for free basic sanitation should cover the hygiene promotion costs and operating costs of providing a basic sanitation service to households. The subsidy for operating costs should be calculated as a subsidy per household per month for each settlement type and technology used. These subsidies should be applied in an equitable and fair manner, both in present context and over time.

The water services authority can influence the financial viability of water services and water services providers through the following mechanisms:

- Investment choices
- Choices related to the use of the local government equitable share
- Tariff policy and the setting of tariffs

- Credit control policies and revenue management
- The contract between the water services authority and an external water services provider

Ongoing operation and maintenance of sanitation systems, as already mentioned, is the responsibility of the water services authority. This is an important aspect in regard to the financial sustainability of sanitation systems and it is discussed in Section 5.

3.3 Implementation of Sanitation Policy in South Africa

DWAF Funded Sanitation Programmes 1997 to 2004

Figure 9 shows the expenditure by each province on its rural sanitation program from 1997-2006. The expenditure by the Western Cape and Gauteng provincial governments on rural sanitation projects is considerably lower than the other provinces due to the low numbers of their rural populations. The highest spending across the nine provinces on rural sanitation occurred in the year from April 2003-March 2004 which coincided with National government elections in April 2004.

The total number of toilets built in the rural areas for each province between April 1994 and March 2005 is shown is Figure 10. KwaZulu-Natal and Eastern Cape both have large rural populations and as a result have built the most number of toilets. The cost of these toilets, illustrated in Figure 11, varies from province to province. The cost of toilets built in Limpopo province is significantly higher than in the other provinces of South Africa.

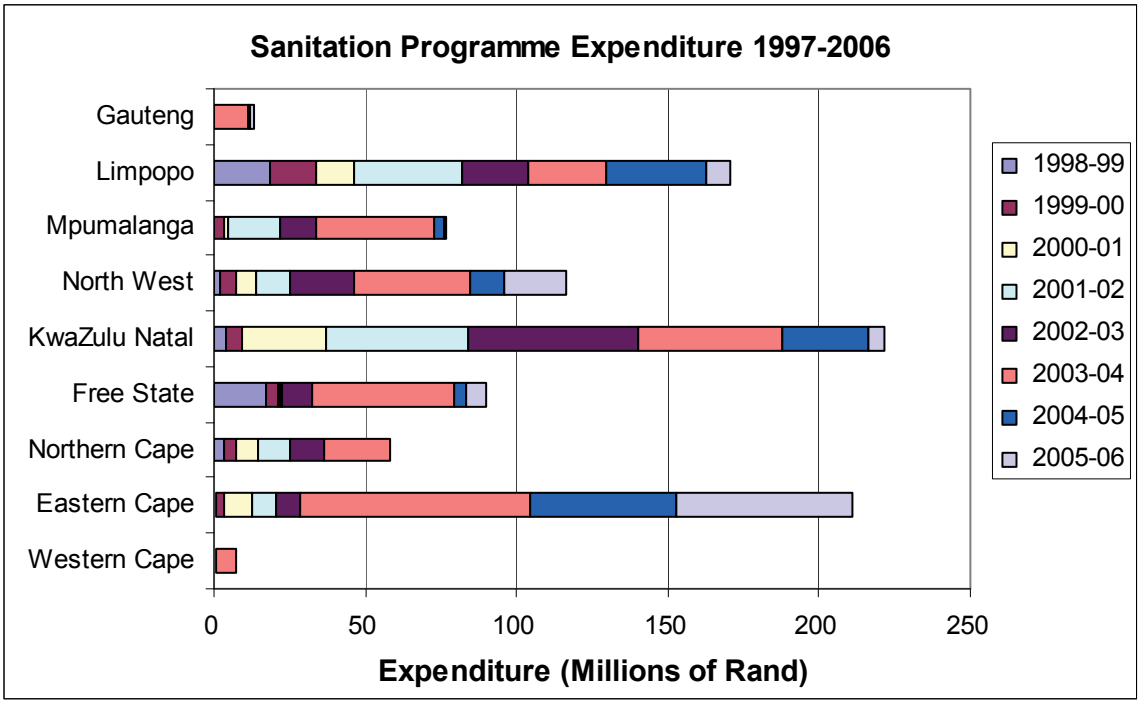

Figure 9: DWAF Expenditure per province on rural sanitation 1997-2006
(after DWAF, 2006)

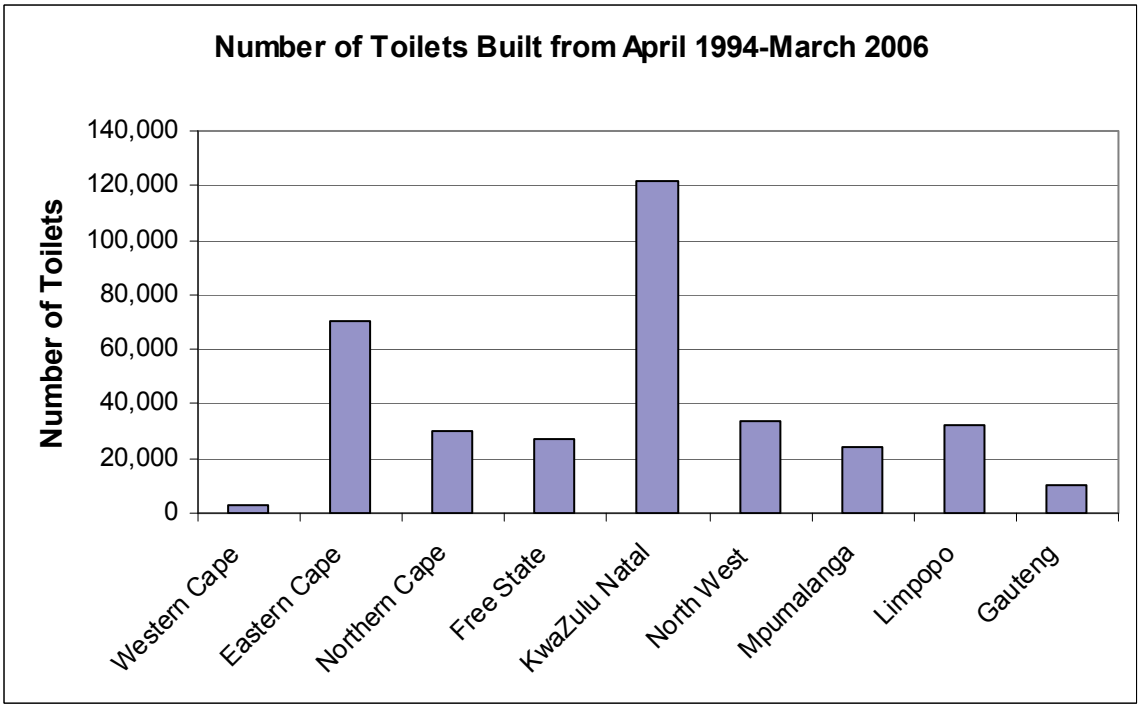

Figure 10: Number of toilets built per province as part of DWAF's rural sanitation programme (after DWAF, 2006)

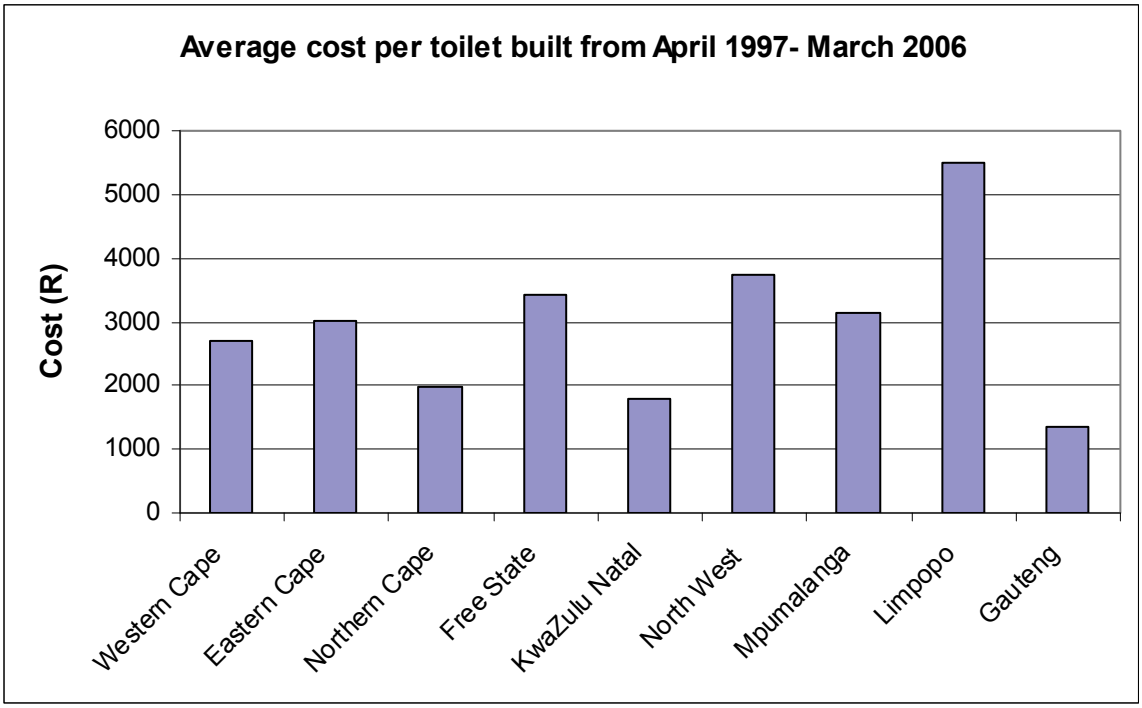

Figure 11: Average cost per province for each toilet as part of DWAF's rural sanitation programme (after DWAF, 2006)

The number of toilets being constructed per annum nationally is increasing as well as the expenditure on rural sanitation; this is illustrated in Figure 12.

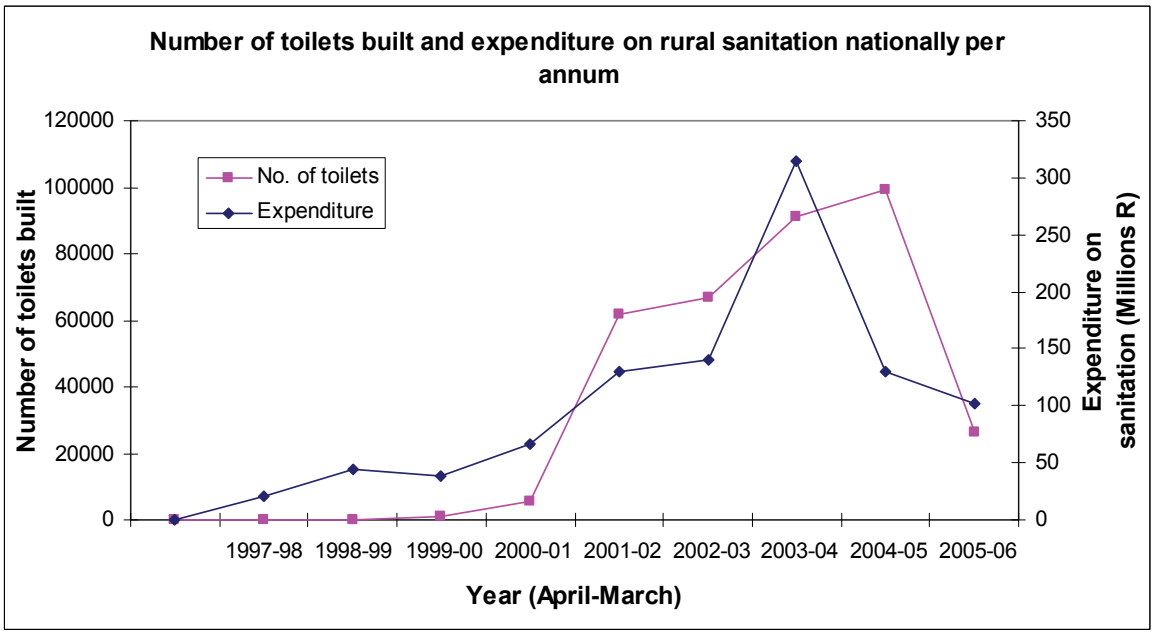

Figure 12: The number of toilets built nationally per annum as part of DWAF's rural sanitation programme (after DWAF, 2006)

The reason that the construction curve drops so sharply after 2004-2005 is that from mid 2004 onwards the Department of Provincial and Local Government (dplg), through its MIG programme and local government structures, was responsible for all water and sanitation delivery. Table 11 below shows that the dplg reported on construction of 74 245 toilets in 2004/05, 142 993 in 2005/06 and 174 346 in 2006/07. Table 11 shows that DWAF had completely wound down its sanitation delivery function by the end of 2005/06. dplg, on the other hand has accelerated its delivery over the three years from 2004 to 2007. Table 11 shows that since 1994 the majority of toilets (2 086 064) have been constructed by the Department of Housing (DoH), but also shows that the DoH is slowing down. Some caution may need to be applied to the literal interpretation of these results, as some databases reflect projects as complete once the business plans have been approved, which may precede actual physical completion by several years. Total sanitation delivery, after dipping in 2005/2006, had increased to 380 806 in 2006/2007.

Table 11: Basic Sanitation delivery in South Africa since 1994

Responsible Department	Households served 1994-Mar 07	2004/05	2005/06	2006/07
DWAF	353,589	107,343	25,226	0
DPLG	391,584	74,245	142,993	106,833
DOH (Housing)	2,086,064	178,612	137,659	273,973
TOTAL House-holds Served	2,831,237	360,200	305,878	380,806

An average national figure for the cost of an individual toilet per annum is shown in Figure 13. The average national figure was calculated by dividing cumulative expenditure by the cumulative number of toilets built. It is anomalous that the cost appears to be going down with time. Two possible explanations are:

i) As the programme has scaled up economies have been realised.

ii) The data is inaccurate (e.g. toilets incorrectly reported as complete)

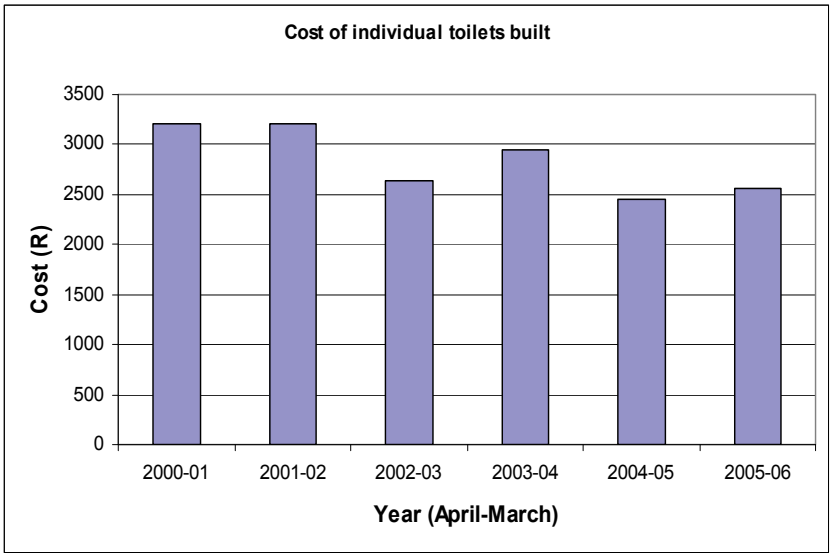

Figure 13: The cost of an individual toilet calculated by dividing the cumulative expenditure by the cumulative number of toilets built (after DWAF, 2006)

3.4 Current DWAF sanitation backlog estimates

Although DWAF is no longer the implementing agent for sanitation projects around the country, it is still the water and sanitation sector leader. A key part of this role is monitoring and regulation. Every three months DWAF's Monitoring and Evaluation unit produces a quarterly report which is called the *Consolidated Water Sector Report*. According to the sector report for the period ending March 2007 South Africa's sanitation backlog is estimated at 3 439 544[5] homes. At present rates of delivery (see Tables 11 and 12), and assuming the population growth continues unabated, it will take at least 15 years for the sanitation backlog to be eradicated.

[5] The DWAF Sanitation Unit Report for April 2008 puts the backlog figure at 3 207 128, with delivery for the year ending March 2008 at 318 663. In December 2008 the backlog figure was estimated at 3 311 512 households, more than 100 000 higher than the estimate of March 2008. Due to population growth, immigration and rural-urban migration, backlog estimation is complex and estimates will fluctuate.

Table 12: Number of Households (per Region) served in the 2006/07 financial year

Region	Backlog: October 2001 (per Census results) – below RDP	Backlog: April 2006 – below RDP level	Households served: April 2006 to March 2007				Unofficial Backlog: March 2007
			MIG (Household sanitation excluding buckets)	Buckets (MIG funded)	Housing	Total Household Sanitation delivery	
EC	930,643	642,852	87,509	22,818	2,784	113,114	529,738
FS	348,437	274,269	23,111	27,698	4,400	55,209	219,060
GT	464,240	401,889	-	200	3,603	3,803	398,086
KZN	1,032,613	718,582	10, 186	-	6,572	16,758	701,824
LP	901,328	814,835	10,119	-	2,391	12,510	802,325
MP	**381,084**	**335,972**	48,785	3,435	2,211	54,431	281,541
NW	**487,145**	**416,688**	17,700	11,731	386	29,817	386,871
NC	**60,993**	**41,565**	1,867	5,024	4,006	10,897	30,668
WC	**153,226**	**98,530**	5,137	841	3,121	9,099	89,431
TOTAL	**4,759,709**	**3,745,182**	**204,414**	**71,747**	**29, 474**	**305,638**	**3,439,544**

Source: DWAF Consolidated Water Sector Report, March 2007

It should be a matter for concern that the rate of sanitation delivery in 2006/07 in three of the provinces with the highest backlogs, i.e. Gauteng, KwaZulu-Natal and Limpopo, was as little as 1% to 2% of the provincial backlog.

According to the 2001 Census figures the average household size in South Africa, after allowing for collective (shared) living quarters, is 4.0. However the weighted average household size for the provinces with the greatest sanitation backlog, i.e. Eastern Cape, Limpopo and KwaZulu-Natal, is 4.4. Applying this figure to the backlog of 3 439 544 households implies that there were still 15.1 million South Africans living without access to basic sanitation as at March 2007. In the 2001 Sanitation White Paper the backlog was estimated at 18 million.

3.5 WHO/Unicef Sanitation Figures for South Africa

In Section 2 above use was made of the WHO/Unicef Joint Monitoring Programme's mid-term assessment report, which covered the period 1990 to 2002 and which was completed in 2004. According to this assessment (see Table 13 below), South Africa's sanitation backlog decreased from 37% in 1990 to 33% in 2002.

There are a few points to note from this assessment:

- At roughly the same point (2001 vs. 2002) DWAF estimated the sanitation backlog at 18 million, i.e. more conservatively than WHO/Unicef. The explanation for the discrepancy may lie in the fact that the latter classified half of all owner built non-VIP pit latrines as

meeting minimum standards for inclusion in sanitation coverage. This recognises that some owner built pit latrines are of a reasonable standard, and while perhaps not as fly proof as VIPs, they do provide dignity for the users and they do keep human waste from the environment. DWAF does not count any owner built latrines in its records.

- While South Africa has managed to reduce its sanitation backlog during the 1990 to 2002 period by 5%, from 37% to 33%, the rural and urban backlog percentages are little changed (the urban backlog has dropped from 15% to 14%, while the rural backlog has dropped from 58% to 56%). The explanation for this is that during the same period South Africa's urban population has increased by seven million, and more than six million of these have been provided for. This accords with the data in Table 11 above which showed that 74% of all sanitation provision during the period 1994 to 2007 has been provided by the Department of Housing, which operates predominantly in urban areas.

Table 13: Progress with sanitation in South Africa between 1990 and 2002
(WHO/Unicef, 2004)

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	36,848	18,056	49	18,792	51	2,708	15	10,900	58	13,634	37
2002	44,759	25,065	56	19,694	44	3,509	14	11,029	56	14,770	33

Four years later the WHO and Unicef released an update of their report "Progress on Drinking Water and Sanitation, Special Focus on Sanitation" (WHO, Unicef, 2008). In this report they have specifically excluded those dependent on shared sanitation, as this form of sanitation, though better than nothing, is not considered acceptable in the long term. Table 14 shows the new figures. It can be seen that this method increases South Africa's backlog figures to 16.6 million in 1990 and 19.7 million in 2006. Although the estimated backlog has risen by three million in absolute terms between 1990 and 2006, the number of those served has increased to 28.5 million from 20 million.

Table 14: Progress with sanitation in South Africa between 1990 and 2006
(WHO/Unicef, 2008)

Population Figures ('000s)						Number without proper sanitation ('000s)					
	Total	Urban	%	Rural	%	Urban	%	Rural	%	Total	%
1990	36,577	19,020	52	17,557	48	6,847	36	9,656	55	16,603	45
2006	48,282	28,969	60	19,313	44	9,849	34	9,850	51	19,699	41

3.6 Impact of sanitation services: results of a beneficiary survey

Sections 3.3 to 3.5 above have dealt with sanitation in terms of toilet construction. However, to make a difference to public health sanitation has to be much more than the delivery of structures. Health improvement requires a holistic approach to sanitation and hygiene, and requires users to keep the facilities clean and above all to practice hand washing, as many infectious and dangerous diseases are passed on via the hands.

During April and May 2007 as part of an evaluation of the success of the water sector's efforts to improve water and sanitation in South Africa, over 1000 persons were interviewed on a number of matters related to their quality of life in general, and water and sanitation in particular (DWAF, 2007). The interview sample was drawn from communities which had benefited from DWAF water and sanitation projects, and was mostly rural. Of those interviewed, approximately half had access to improved sanitation, and half had not.

When asked whether their **sanitation** had improved since 1994, the respondents with flush toilets were clearly the most satisfied, but those with lower levels of service (VIPs, VIDPs and Urine Diversion toilets were more satisfied than those without. Figure 14 below shows the differences.

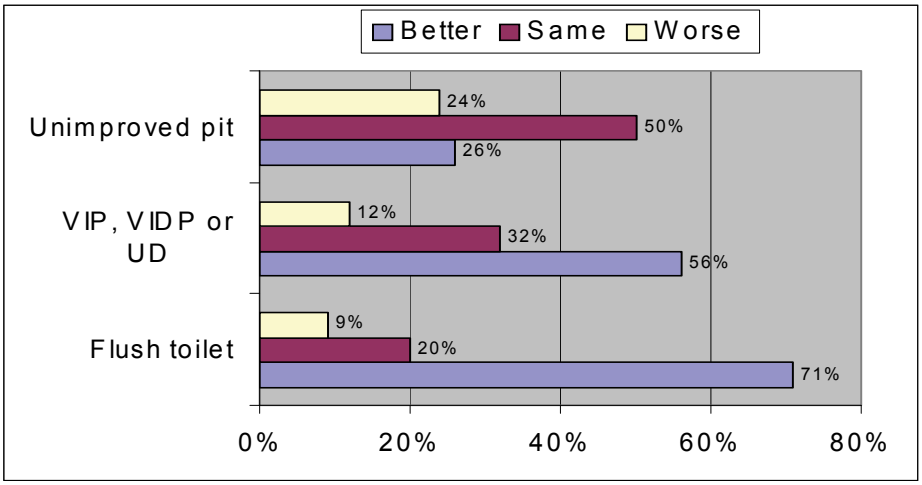

Figure 14: Degree of satisfaction with sanitation, relative to level of service, comparing status in 1994 with 2007

Of the 1025 respondents, 286 (28%) indicated that their area had seen the implementation of a sanitation project. Figure 15 shows the types of toilets encountered amongst the survey sample.

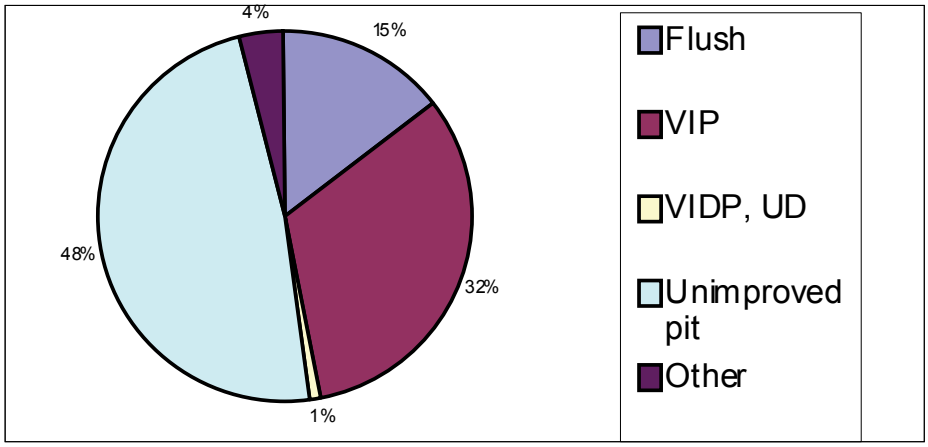

Figure 15: Distribution of sanitation types amongst survey sample.

The respondents were then asked a number of questions related to their sanitation service and their sanitation practices. In answer to the question, Who in your household uses the toilet?, the following answers were given:

Table 15: Does everyone in the household use your toilet?

	Yes	Sample size
Flush toilets	100%	132
VIPs, VIDPs, UDs	89%	297
Unimproved Pits	82%	430

When asked whether anyone inspects the toilets, 85% of all the respondents said that no-one did. A further 4% said the municipality did, and 4% said a private company did. When this result is filtered for the 286 respondents who confirmed that there had been a sanitation project in their area, the percentage who stated that no-one inspects the toilets dropped to 79%. This and other sanitation maintenance related issues are shown in Table 16 below. While there should be ongoing inspections of sanitation facilities as part of health and hygiene behavioural change programmes, the repair and maintenance of private sanitation facilities is the homeowner's responsibility, unless there has been defective design or construction on the part of the municipality's sanitation team.

Of greater concern is the 79% of those who have had sanitation projects who answered that no-one empties pits and septic tanks. This is a function which presumably should fall within the definition of "free basic sanitation".

Table 16: Questions related to toilet maintenance

	% who answered **"No-one"** from full sample	% who answered **"No-one"** from only those where there has been a sanitation project
Who inspects toilets?	85%	79%
Who takes care of toilets?	82%	76%
Who repairs broken toilets?	80%	73%
Who empties pits when full?	82%	79%

The interviewers were asked to observe the quality of the latrines and the standard of hygiene practice at each of the respondent's homes. Tables 17 to 21 below show how the results differed between those who had a VIP versus those who had an unimproved pit latrine. While the results show that the standard of sanitation is improved for those who have had a sanitation project, the differences are not as marked as one might hope. Table 21, in particular, shows that there is no difference in the likelihood that there will be a convenient hand washing facility at an improved sanitation facility relative to an unimproved facility (although in case of the former only 81% of the sample had an improved water supply, and for the latter 94% had an improved supply).

Table 17: Does the toilet smell?

	Those with a VIP (RDP basic level of service)	Those with an unimproved pit latrine
No. Not bad	40%	26%
Yes. A little	37%	31%
Yes. A lot	21%	36%
Yes. Terrible	1%	7%

Table 18: Are there flies in the toilet?

	Those with a VIP (RDP basic level of service)	Those with an unimproved pit latrine
No	34%	20%
Yes. A few	54%	51%
Yes. A lot	13%	29%

Table 19: Is the door kept closed?

	Those with a VIP (RDP basic level of service)	Those with an unimproved pit latrine
Yes	81%	72%
No	19%	28%

Table 20: Cleanliness of toilet

	Those with a VIP (RDP basic level of service)	Those with an unimproved pit latrine
Very clean	17%	10%
OK	64%	56%
Not clean	20%	34%

This question related to the toilet pedestal itself. Another question related to the whole room yielded very similar results.

Table 21: Is there somewhere at or next to the toilet where hands can be washed?

	Those with a VIP (RDP basic level of service) of which 81% also had an improved water supply	Those with an unimproved pit latrine (of which 94% had an improved water supply)
Yes	17%	18%
No	83%	82%

Of those who did have a hand washing facility near their toilets, only half had soap, whether there had been a sanitation project in the area or not.

Sanitation delivery is not just about managing toilet construction programmes. The health benefit of improved sanitation will only be realised with improved health and hygiene practices. This requires training, before, during and after implementation. Most of the respondents indicated that they had received no such training, as shown in Figure 16.

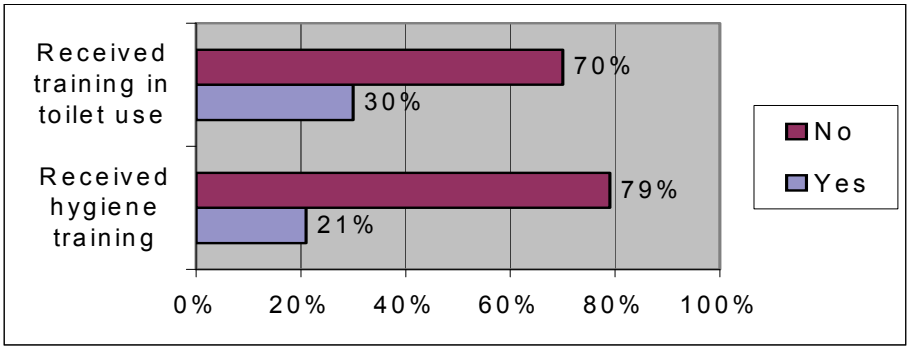

Figure 16: Level of hygiene training acknowledged by respondents

4. SOUTH AFRICAN SANITATION CASE STUDIES

Between DWAF and the dplg almost a million families have been provided with sanitation since 1994. Although there is still more than three times that number to be provided for, it is appropriate that stock should be taken of how things have gone with the sanitation which has been provided. In particular one must ask how the units have fared in practice, and what lessons can be learned for future projects. To get some sense of these lessons, 19 case studies have been carried out, distributed over seven provinces and four sanitation types.

Most of the case studies investigated have significant operational history. The technical options included are VIP latrines, urine diversion toilets, desiccating toilets, and waterborne sanitation which include both septic tanks with soakpits and sewers to treatment plants. The background to each sanitation project, along with project costs and operational history are described for each case study.

Nineteen sanitation projects have been included as case studies. The case studies comprise of:

- 7 VIP latrine case studies (3 in KwaZulu-Natal, 2 in Eastern Cape, 1 in Mpumalanga, 1 in Limpopo)
- 6 Urine Diversion System case studies (1 in KwaZulu-Natal, 1 in Eastern Cape, 2 in Western Cape, 1 in Northern Cape, 1 Gauteng)
- 5 Waterborne sanitation case studies (2 in KwaZulu-Natal, 3 in Western Cape)
- 1 Septic tank case study (in KwaZulu-Natal).

4.1 VIP Latrines

4.1.1 Inadi, Pietermaritzburg

Project Background and Implementation

Inadi is a peri-urban area situated on steep sloping land which lies due west of Pietermaritzburg and Hilton in KwaZulu-Natal. The Inadi sanitation project was implemented initially by the Institute for Natural Resources (INR) in 1995, and later by Thuthekile Consulting. The Siyathuthuka Sanitation Committee was formed in 1994 and existed until November 2005. Over 200 Phungalutho VIP latrines were built in the first phase (1995) of the sanitation project.

The Phungalutho latrine is a variation on the VIP and has both a domed pit cover and superstructure roof. The reinforced dome of the pit cover is positioned higher than the pedestal base. This helps create a constant one-way air flow up the vent pipe (Devan, 1997). The Phungalutho design is shown in Figure 17.

Allocation of the VIP latrines was demand driven so if a household desired a VIP latrine to be built they were required to register with the Siyathuthuka Sanitation Committee. The committee's responsibilities included hiring local people to work on the sanitation project, arranging the appropriate skills training, and financial management of the project. The funder paid money into the committee bank account and materials were then bought and local builders hired to carry out construction. Members of the committee also checked the number of latrines built and the quality of the construction.

Any problems or grievances encountered by households receiving VIPs were reported to the sanitation committee and it was the committee's task to take things further.

The Siyathuthuka Sanitation Committee oversaw the health hygiene awareness. The training was carried out by people recruited by the committee and by the committee themselves. The focus of the health and hygiene training was on how to look after the toilet and on hand washing.

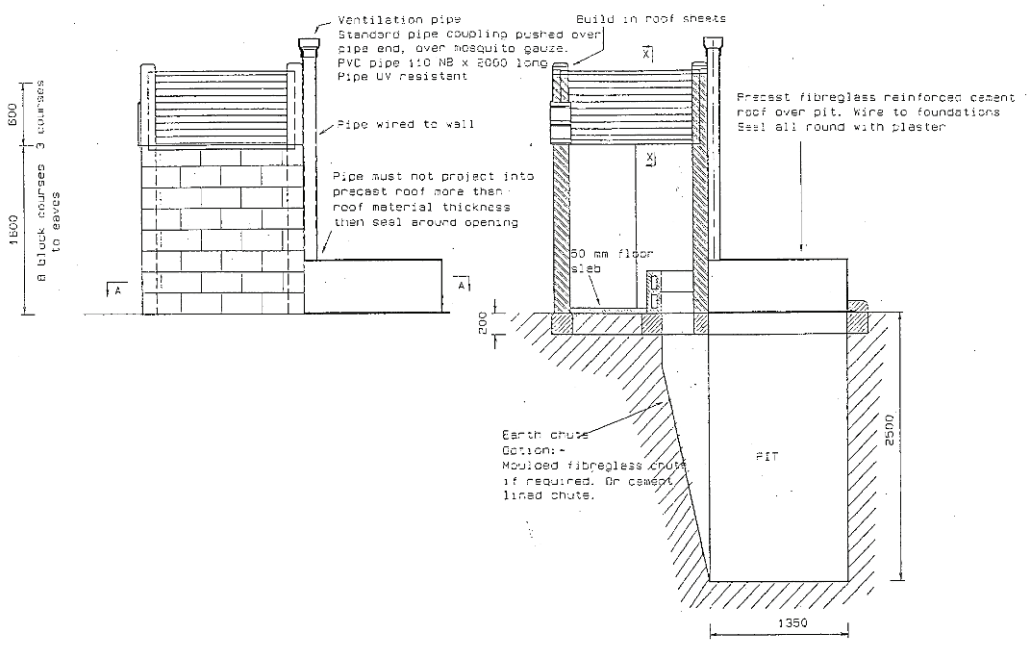

Figure 17: Side elevation (on the left) and sectional elevation (on the right) of VIP design (Phungalutho) used by the Institute of Natural Resources in the Inadi and Mbazwana sanitation projects (Murphy and Still, 1995)

Project Costs

The construction costs of the Phungalutho VIP latrine at Inadi are given in Table 22, the 1995 prices for materials and labour have been escalated to 2008 prices (the costs were calculated using inflation indices from Statistics SA and using current prices for materials and labour). Not included in the 1995 price are the costs of the management by the Institute of Natural Resources.

The householder who had registered for a Phungalutho latrine was required to dig the foundations and pit for the toilet chamber. In subsequent years the R600 government subsidy for each household receiving a VIP latrine did not cover the cost of the superstructure so the householder had to contribute costs. The amount contributed depended on the type of superstructure that was being built. The householder was also free to finish the construction of the superstructure themselves, however, not all were finished to a good standard and, as a consequence, some have collapsed.

Table 22: Schedule of quantities and material costs for a Phungalutho latrine at Inadi sanitation project (after Crawford and Kafile, 1995)

	Material	**Cost R (1995)**
1	Blocks (140)	280
2	Vent, gauze, socket	20
3	Cement (5pks)	100
4	Chicken wire (3.4m)	20
5	Plain wire	10
6	Paint for vent	0.50
7	Sand and stone	80
8	Transport (small load)	60
9	Builder's cost (contractor)	220
10	Pit Inspector	9.50
Total		800

The 1995 labour and materials cost escalated to 2008 prices would be approximately R2 500. Note that the above costs exclude management costs.

Operational History

Twenty seven houses were visited in the Imbubu ward of Inadi in early 2006. The households visited had Phungalutho latrines built in 1995. Table 23 shows the filling rates of the pits visited. Of the 27 households visited 16 had VIP latrines that were full.

Table 23: Filling rates of Phungalutho latrines at Inadi sanitation project for latrines built in 1995 (* latrines built in 2000)

No.	Number of users	Height of Pedestal (m)	Depth of sludge from top of pedestal (m)	Filling rate l/p/yr	Comments
1*	5	0.35	0.70	58	Toilet full
2	n/a		Toilet not used		Family have inside toilet with septic tank
3	7		Toilet full		New VIP financed by family
4*	9		Toilet full		Infested with maggots, high ground water
5	4	0.35	1.08	59	
6	9		Toilet full		New VIP financed by family
7	4	0.40	0.80	71	Toilet full
8	11	0.35	1.00	23	
9	5	0.40	0.60	62	Toilet full
10	5		Toilet full		New VIP financed by family
11	4		Toilet full		New VIP financed by family
12	8		Toilet full		Latrine built as replacement
13	8		Toilet full		New VIP financed by family
14	8	0.35	0.00	48	Toilet full
15	7	0.35	0.85	39	
16	5	0.35	0.60	61	Toilet full
17	4	0.35	1.20	56	
18	5	0.40	1.90	27	Owner uses an additive
19	5	0.40	0.80	57	
20	3	0.40	0.00	131	Toilet full
21	5	0.40	1.20	46	
22	7	0.40	0.70	42	Toilet full
23	6	0.40	0.73	49	Toilet is full; hole in the pit chamber roof
24	7	0.40	0.80	41	Householder extended pit in 2004
25	5	0.35	0.90	53	
26	4	0.40	1.40	51	
27	4	0.40	1.35	52	

The more affluent families have been able to have new VIP latrines built. Local builders in the community have the skills to build new Phungalutho latrines using the original block

design (Figure 18, left) or they can construct a version that enables the superstructure to be moved when the pit is full, shown in Figure 18, right.

An alternative to the construction of new latrines would be for the latrines to be emptied. The members of the Siyathuthuka Sanitation Committee were not aware of any plans by the municipality to empty full latrines. It appears that it is the responsibility of the householder to empty the latrine or construct a new toilet, although this has not been made clear to the community. For the poorer members of the community a full latrine poses problems as they do not have the finance to have the pit emptied or to construct a new VIP latrine.

The median filling rate of the households shown in Table 23 is 52 litres per person per year. Data quoted by Still (2002) gives 30 litres per person per year as a reasonable guideline figure for sludge accumulation rates in pit latrines. This data recorded in the Imbubu ward is above that guideline figure. A possible explanation for this is that the fully offset pit configuration (see Figure 17 above) does not use the pit volume as effectively as a conventional design, with the result that the observations tend to overestimate the filling rate. Another is that the pits being unlined were not dug to the exact dimensions shown on the plan, and there is field evidence from at least one emptied latrine that supports this explanation.

Figure 18: Phungalutho latrine constructed in Inadi in 1995, photo taken in 2006; new VIP (PET calcamite) with a movable superstructure that some families have had constructed when the Phungalutho latrine built in 1995 became full

4.1.2 Mbazwana Sanitation Project, Northern KwaZulu-Natal

Project Background and Implementation

The Mbazwana area of KwaZulu-Natal has a low density rural population. The sanitation project in 1995 was implemented by the Institute for Natural Resources on behalf of the Mvula Trust. It is estimated that 103 latrines were constructed for the Mbazwana Pilot Sanitation Project in 1995 using variations of the Phungalutho pit toilet (Louw and Mlambo, 1995).

The design of VIP used in the Mbazwana project was based is pictured in Figure 19. This sanitation project used the Phungalutho toilet which was built from sandy soil dug from the pit over which it stands. The pit was lined with six precast mortar rings which were moulded on site by a local subcontracting team. The circular slabs for the latrines were cast in two halves and cemented together over the pit.

In 1995 VIP toilets were new to the area so community health workers taught family householders how to use the toilets. To qualify for the subsidy for the toilet householders were required to attend a health workshop.

Project Costs

The project cost for construction of the Phungalutho VIP latrines is shown in Table 24, quoting the original 1995 prices. Not included are the costs of the management by the Institute of Natural Resources. The 1995 prices for materials and labour have been escalated to 2008 prices using a combination of inflation indices from Statistics SA and current material costs and rural labour costs.

The home owner was responsible for the levelling of the site and digging of the pit for the toilet chamber. The pilot project initially experienced logistical problems because of the dispersed nature of the settlements. Transport costs were a major concern of the project team so rings for the lining of the pit were built on site (Louw and Mlambo, 1995).

Labour for the construction of the Phungalutho VIP constructed at Mbazwana works out in 2008 prices at R1 716, which is relatively high. The high labour costs are due to the 24 man days of labour required for construction, which included the construction of the rings for the pit. Rural labour price per day for this area has increased from R15 per day recorded by the INR in 1995 to the R75 per day which is current now. The total cost of Phungalutho construction in 2008 prices is shown in Table 25.

Table 24: Cost per unit of toilets at Mbazwana sanitation project, (after Louw and Mlambo, 1995)

Phase	Labour (R)	Materials (R)
Make rings	45	160
Sink rings and foundation	45	24
Superstructure	135	192
2 Roofs and pedestal	90	64
Finishing walls and toilet seat	45	
Extra labour costs & transport	100	100
Total	460	540
TOTAL COST 1995 (R)	**1000**	

Table 25: Cost per unit of toilets at Mbazwana sanitation project (2008 prices)

Item	Cost (R)
Labour	1716
Materials	996
Household contributions	143
Total	2 855

Note that the above costs exclude project management and supervision costs.

Operational History

An example of one of the Mbazwana pit toilets after 10 years of use is shown in Figure 19. The rings used in construction of the larine pits were either 1 metre or 1.3 metres in diameter. A selection of the latrines was surveyed in 2000 so that pit filling rates could be estimated. The results of the 2000 survey are shown in Table 26. In January 2006 the Mbazwana Pilot Sanitation project was again surveyed for pit filling rate and the general condition of the toilets was assessed. The results are shown in Table 27.

In the 2006 survey 25 households were visited. Of the 25 households it was found that four of the latrine superstructures had collapsed which rendered them unusable. At household number 1 (see Table 27) the superstructure had collapsed in 2005, at which stage the latrine was not yet full. The collapsed superstructure is shown in Figure 20 (left). The VIP has now been replaced by the householder with an indoor toilet with a septic tank.

Household number 2 (Table 27) also had a collapsed toilet superstructure. This occurred in December 2005, and again the latrine was not full. The family controlled the build up of waste in the chamber by occasionally pouring petrol down into the pit and burning it. A new VIP was built for the household in 2002, but they continued using the latrine constructed in 1995 until it collapsed. Householders 5 and 9 also experienced VIP superstructure collapses and now have new latrines. At three of the other households visited there was considerable damage to the roof of the latrine chamber. An example of this is shown in Figure 20 (right).

Figure 19: VIP toilet constructed in 1995 at Mbazwana northern KwaZulu-Natal
(picture taken in January 2006)

Table 26: Results of survey on Mbazwana Pilot Sanitation Project carried out in 2000

No.	Ward	Name	Number of Users	No. rings installed	Height of Pedestal (M)	Depth of sludge from top of pedestal (M)	Filling rate L/p/yr
1	Olankeni	Zikhali	8	4	0.40	1.00	33.20
2	Olankeni	M.Kunene	7	6	0.35	2.35	15.20
3	Olankeni	B.Zikhali	14	5	0.50	1.80	13.30
4	Olankeni	M Mkize	6	5	0.40	2.00	17.70
5	Esiphahleni	S.Nxumalo	10	6	0.50	2.00	23.90
6	Esiphahleni	J.Mthembu	10	6	0.45	2.25	16.00
7	Esiphahleni	M.Ngobese	12	5	0.45	1.60	18.80
8	Esiphahleni	N.Nsele	8	6	0.50	2.42	16.00
9	Esiphahleni	G.Ncube	20	6	0.40	2.05	9.95
10	Esiphahleni	E.Nsele	14	6	0.40	1.65	21.80
11	Hlamnu	E. Ndlouvu	5	6	0.40	1.65	21.80

Table 27: The results from January 2006 survey on toilets constructed in 1995 Mbazwana Pilot Sanitation Project

No.	Ward	Name	Number of current users	Height of pedestal (M)	Depth of sludge from top of pedestal (M)	Filling rate L/p/yr
1	Olakeni	M.Kunene	4	Superstructure collapsed		
2	Olakeni	B. Zikhali	14	Superstructure collapsed		
3	Olakeni	M.Mkize	10	0.50	1.20	23.9
4	Esiphahleni	G.Ncube	20	0.35	0.75	13.9
5	Esiphahleni	M.Ngobese	12	Superstructure collapsed		
6	Esiphahleni	J. Mthembu	8	0.45	1.30	27.4
7	Esiphahleni	E Nsele	12	0.40	0.70	31.3
8	Esiphahleni	M.Temba	2	0.40	1.37	101.5
9	Esiphahleni	N.Nsele		Superstructure collapsed		
10	Qongwana	M.Zikhali	10+	0.45	1.07	24.9
11	Qongwana	S.Nsele	7	0.40	1.20	32.2
12	Esiphahleni	B.Nsele	4	0.40	1.10	59.7
13	Esiphahleni	S.Zikhali		Toilet chamber roof collapsed		
14	Olakeni	T.Mlambo	12	0.40	1.30	17.7
15	Hangza	S.Ntuli	8	0.40	1.00	31.5
16	Hangza	S.Zikhali	7	0.40	1.30	30.3
17	Hangza	B.Zikhali	10	0.50	1.44	20.7
18	Hangza	N.Zikhali	5	0.50	1.55	38.5
19	Hangza	S.Hlongo	8	0.50	1.42	26.2
20	Manzibomvu	D.Ntuli	9	0.50	1.02	29.2
21	Manzibomvu	M.Nguni		Toilet no longer used		
22	Manzibomvu	J.Ngobese	7	0.40	2.00	17.1
23	Manzibomvu	M.Zikhali	1	0.40	1.97	123.4
24	Manzibomvu	L.Zikhali	2	0.40	1.72	78.3
25	Manzibomvu	G.Mbonanbi	4	0.40	2.08	27.2

The soil in the Mbazwana area has almost no clay content. This could contribute to the collapse of the latrine superstructures as the sand surrounding the rings can work its way into the pit through gaps in the lining and so weaken the foundations of the latrine. At other households where cracks have occurred in the toilet chamber roof, the cracks have been repaired and this appears to have prevented the cracks from enlarging and causing the roof to collapse.

The median of the 2000 results was 18 litres/person/annum. The median from 2006 is 29 litres/person/annum. There are four major anomalies relating to pit filling rates in Table 27. These are for Household numbers 8, 12, 23 and 24. The pit filling rates are much higher than expected. The reason for this is likely to be that there have previously been more users of the latrine than the current figure stated. For example, the latrine for household number 23 was used by the whole family until a new latrine was built and now currently only one family member uses the latrine. The date of completion of the newer latrine is however uncertain which makes accurate filling rates difficult to estimate.

Figure 20: Collapsed VIP at Mbazwana northern KwaZulu-Natal (left); VIP toilet with a collapsed latrine chamber roof (right)

4.1.3 Newlands Sanitation Project, Buffalo City, Eastern Cape

Project Background and Implementation

The project was implemented by the Amathole District Municipality to meet the acute need for sanitation in a peri-urban settlement accommodating approximately 30 000 people in an environmentally sensitive location in the catchment area for the Nahoon Dam. The Nahoon Dam is one of the principal sources of water for Buffalo City. The project comprised the construction of 1098 toilets from May 1998 to September 1999.

The VIP construction consisted of a block building with a lined pit, a corrugated iron roof, and metal door and frame. Newlands is in the catchment area of the Nahoon Dam and to allay any fears of contamination the pits were lined. Selected community members were trained as builders, and others were employed to dig pits, and transport materials. A community based committee assisted the professional team with liaison, labour procurement, and social facilitation. The family receiving the toilet were not required to contribute financially or by means of sweat equity. In 1998, 3 600 toilets were required in this area but due to budget constraints only 1098 were constructed. Since then the population of Newlands has increased considerably, now estimated at about 48 000 people or 8 000 households. Health and hygiene education was neither part of the initial project scope nor part of ongoing operations and maintenance.

Project Costs

The project was funded by the Cape Provincial Government through the transitional regional structures in place at the time. The overall project cost was R3 732 621. The cost per VIP constructed was R3 399 in 1998 (R7 043 in 2008 prices). The breakdown of project costs per VIP latrine is shown in Table 28.

Table 28: Project costs per unit for VIP construction in Newlands, Buffalo City

Item	Cost 2002 (R)	Cost 2008 (R)
Materials	1 762	2 891
Labour	753	1 235
Total	**2 515**	**4 126**

Note that the above table excludes management costs.

Operational History

Where the toilet was constructed for use by several households, responsibility for maintenance was undefined, and wind damage to doors and frames occurred. In these instances, the toilets also filled up much quicker, due to severely increased loading.

In general, those toilets constructed within household premises seem to have been maintained to a higher standard (Figure 21). The biggest problem is the lack of education and awareness concerning the materials deposited in the pit. This results in problems for the vacuum tanker staff when attempting to empty the pit, as un-decomposed and laminated materials make pumping impossible. Between 10 and 12 percent of the pits have been partially evacuated once in the last 5 years and many are reported to have overflowed. Most now appear to be between 75 and 85 percent full.

Evacuated VIPs using a municipal vacuum tanker requires the introduction of about 700 to 1000 litres of water per latrine. The level of sludge in the pit is reduced by about 30% before further pumping becomes impossible due to laminated layers of paper, plastic packets, and other foreign matter that does not decompose or liquefy. The municipality discharges the tanker sludge into the water-borne sanitation gravity mains. This accomplishes the required dilution, but incurs further problems with blockages due to the foreign objects from the pits now discharged into the gravity mains.

Figure 21: VIP superstructure constructed at Newlands

The cost to the user was R130 per trip (2006 Rands). The actual cost was then approximately R730, representing a municipal subsidy of about R600 per trip. Additional costs due to blockages of sewer mains after discharge from tankers are not identifiable in isolation, but should not be ignored. If one assumes that 30% of each pit is emptied once every 2 years, and that it is emptied for the first time in year six, the monthly cost to the municipality in 2006 would have been R25 per month per toilet older than six years (R600/24 months = R25).

The smell from the VIP toilets is often almost overpowering, particularly at midday in summer. Flies are also extremely numerous, and could have an impact on the health of the residents. It is likely that both of these problems are exacerbated by the presence of foreign matter in the pit. This prevents faeces and urine from separating, causing the smell and attracting the flies. The conclusion reached is that there could be a huge improvement in the sanitation service, if the people were exposed to ongoing health and hygiene awareness

education. The most common damage incurred in the toilets visited appears to be from wind damage to open doors.

4.1.4 Thembalethu, Tsolwana Municipality, Eastern Cape

Project Background and Implementation

The Thembalethu sanitation project, which was implemented by Rural Support Services, was one of twelve pilot projects funded by the Mvula Trust between 1994 and 1996. The construction consisted of single and double lined pits, with a brick and mortar superstructure with a wooden door and frame and a corrugated iron roof. From November 1994 to November 1996 there were 101 VIP latrines constructed, of which 44 were single pit latrines and 57 were double pit latrines. The community nominated trainee builders, and all labour was supplied by the householders.

There was a health and hygiene programme and village health workers were trained and worked with a nursing sister from the Department of Health. The programme included drama, music and literature to communicate the health and hygiene message.

Project Costs

The cost in 1995 was approximately R775 per unit for a single pit, and R985 for the double pit. The breakdown of costs for the single pit construction is shown in Table 29. The cost of construction per unit in 2008 prices is R2 217. The project was funded by The Mvula Trust, and implemented using the government subsidy which in 1995 was R700 per household. Householders were expected to dig the pit, transport all the materials from the site store to the latrine site and, due to the limited subsidy available at the time, to provide the door, frame, hinges, and bolt. Those requiring a double pit were required to contribute an additional sum of R210 (1995 costs).

Table 29: The breakdown of capital costs for single pit VIPs in Thembalethu, Tsolwana Municipality, Eastern Cape (the 2008 prices were calculated using current material prices and including an average figure for labour and management)

Item	Cost 1995 (R)	Cost 2008 (R)
Materials	535	1530
Door (Household contribution)	175	501
Labour	65	186
Total	**775**	**2 217**

The reported labour costs are very low, and must indicate that either the builders provided part of their time as a voluntary contribution in this small and closely knit community, or otherwise they were paid an additional amount by the home owners.

Operational History

A site visit was undertaken, and 20 toilets were chosen at random and inspected. The results of the site visit are shown in Table 30.

The toilets are emptied by the removal of the concrete cover slab at the rear of the toilet, and by manual excavation. With a double pit latrine each pit is typically emptied after 2 years usage, and 2 years decomposition.

The quality of the materials originally used in construction was acceptable, but the amount of cement used in the mortar was inadequate. This is borne out by the number of structures that had collapsed during storms and strong winds. It was noted that vandalism had assisted in the destruction of toilets especially where a toilet was not in regular use (Figure 22).

Table 30: Condition of VIPs in Thembalethu, Tsolwana Municipality, Eastern Cape during January 2006 assessment

VIP Component	No. out of 20 assessed
Pit No 1- OK	8
Pit No 2 – OK	6
Door and frame – OK	4
Brickwork – OK	5
Roof	14
Usage – acceptable	4
Usage – not in use	6
Usage – unacceptable	10

Figure 22: Damaged superstructure of VIP latrines in Thembalethu, Tsolwana Municipality, Eastern Cape

The knowledge of how to construct a double pit toilet is retained in the village, as a sound structure was constructed at the village crèche by a local builder. The knowledge of good health and hygiene practices is also still retained in the village, as demonstrated by the toilets that were found to be safe, hygienic, and well maintained. The poverty of residents was blamed for the poor standards. Some community members expressed the opinion that the village would benefit from further health and hygiene education.

4.1.5 Nkomazi Local Municipality, Mpumalanga

Background and Implementation of Project

The Nkomazi Sanitation Pilot Project in Mpumalanga Province constructed 180 toilets in three villages form March 1995 to March 1996. The technology option was a VIP latrine with a lined pit. The pits were dug to a minimum depth of 2.5 m. Three superstructure options were offered: blocks with a walk around entry instead of a door; blocks with a door; and a spiral design with a walk around entry instead of a door (Figure 23).

Figure 23: The three types of VIP built in Nkomazi in 1995: spiral mould (left), blocks with no door (centre) and blocks with door (right)

The pilot study was in ward 29 of the Nkomazi Municipality. According to Census 2001 there were then over 1200 VIP latrines in the ward compared with 500 pit latrines without ventilation.

No additional funding was provided for health and hygiene education. However a voluntary community group started in 1987, called Care Group Mothers, spend one week per month teaching good health and hygiene practices to school learners and mothers at schools and other local facilities.

Project Costs

The Mvula Trust provided R700 for the construction of each toilet as well as funding for the project agents, Medecins Sans Frontieres (MSF). Householders who were to be the beneficiaries of VIP latrines were responsible for paying the difference between the cost of the option they chose and the R700 subsidy per toilet provided by the project funders. The VIP costs are shown in Table 31. Participants were expected to take responsibility for pit digging and making the blocks for the pit lining. Lining of the pits and the building of the superstructure was carried out by locally trained artisans. If householders did not want to be responsible for pit digging or block making they could make additional contributions of R120 and R20, respectively, to the Sanitation Committee. This option was allowed for in the contract between the Sanitation Committee and the householder.

Table 31: The capital cost summary of sanitation options (includes labour and materials) per unit at Nkomazi, Mpumalanga

Item (VIP with door)	Cost 1995 (R)	Cost 2008 (R)
Labour	300	897
Materials	670	2 010
Total	970	2 907

Operational History

All the toilets constructed during the pilot project are still structurally in good condition. During the pilot project nearly half the households chose the spiral mould design, with some choosing the block type with walk around entry and no door and very few choosing the third type with a door. According to David Mhlanga, of the Nkomazi Sanitation Committee, the choice was strongly influenced by the required contribution of the household for the more expensive option with a door. Mhlanga continued that ‘if the required contribution for each type had been the same, the numbers would have been reversed’. However, the door

frames that were installed were of a poor quality and have failed because of corrosion. From an inspection of the condition of the toilets it is apparent that only limited maintenance has been carried out on the VIP superstructures by the householders.

Only a small number of the VIPs constructed in 1995 had pits that were full at the time of this field visit (late 2006). This can be attributed to the large pit size, with the volumes being between 3 to 4 m^3. The municipality is only at the initial stages of considering ways of introducing a latrine emptying service. Although not municipal policy, some households are managing to obtain a second subsidy to build a new toilet.

4.1.6 Newline, Limpopo Province

Background and Implementation of Project

Newline is situated in the Bushbuckridge Local Municipality. The Newline sanitation project was implemented in 1995. The toilets constructed were VIPs with lined pits that were circular for optimum strength with the just the top and bottom three courses being mortared. Three conventional cement block superstructures were offered. Two were very similar, the only difference being the size of the wire mesh vent above the door. The third had a screen wall in place of a door.

The Newline Community Sanitation Committee was involved in the project from before the first feasibility study was carried out with the help of the University of Witwatersrand's Wits Rural Facility which acted as the Project Agent. The Project Agent's responsibilities included: designing and costing the different VIP options for the community; producing design drawings and bills of quantities; and assisting the Community's Committee with project management and site supervision.

In part fulfilment of their responsibilities to promote sound health practices within the community, the Wits Rural Facility produced a 16 page booklet titled *The VIP latrine for family health.* Local actors also produced a health education drama, but it was only performed once because the actors required payment for additional performances.

Project Costs

The Mvula Trust provided a subsidy of R725 for the construction of each toilet. They also funded the Project Agents, Wits Rural Facility. The householders were responsible for paying the difference between the cost of the option they chose and the R725 subsidy per toilet provided by the project funders. The capital cost of a VIP with a door is shown in Table

32. A member of the participant's household was responsible for making the cement blocks for the pit lining and superstructure using a block mould and sieve provided by the Sanitation Committee. These were loaned for a maximum period of 14 days. All other work was done by the local builder with the assistance of the member of the participant's household.

Table 32: The capital cost summary of VIP construction (includes labour and materials) per unit at Newline, Limpopo

Item (VIP with door)	Cost 1995 (R)	Cost 2008 (R)
Labour	180	515
Materials	655	1873
Total	835	2 388

Operational History

Examples of the VIPs constructed at Newline are shown in Figure 24.

No full pits were observed and community members are not aware of any toilet pits that require emptying. Jonathan Maile, who was a member of the Newline Sanitation Committee at the time of the pilot project, said most of the pits were 2.9 m deep and 2.6 m was the minimum depth. On this basis the pit gross volumes varied between 5.2 and 5.8 m^3.

Figure 24: VIP latrines constructed at the Newline sanitation project in 1995

The pilot project in 1995-1996 was followed by a phase 2 project facilitated by AWARD in 2001-2002 when approximately another 190 VIP toilets were constructed. Community involvement appears to have been less during Phase 2 than during the original pilot study.

The Bushbuckridge Municipality currently offers no pit emptying service. The municipality also commented that none of the pit toilets in the municipality were designed for the removal of sludge. Although the municipality believed they should be offering such a service they were unsure of what approach to use particularly as access to many toilets is limited.

4.1.7 Msunduzi Municipality (Wards 6 and 7) Sanitation Programme

Project Background and Implementation

The Msunduzi Municipality obtained approval for a project to eradicate the sanitation backlog in the Vulindlela area, which was estimated at 30 000 latrines in 2005. Implementation is being carried out simultaneously in 10 different wards using a number of project agents. The backlog for wards 6 and 7, which are located in the Elandskop area, was estimated at 5 000 units. To date 4 000 units have been constructed.

The designs being used are shown in Figure 25. Initially a concrete roof was used (Figure 25, left), which was divided into three sections to facilitate transport and construction. However the sealing of the butt joints between the slabs was time consuming and costly, and as a result the design has been changed to incorporate a steel roof (Figure 25, right).

The householder is responsible for the levelling of the site and the digging of the pit, the moving of the building material from the nearest accessible drop off point to the house, and the security of this material once it is delivered to the house until the VIP has been constructed. During construction the householder provides all the water required by the builder and his assistant, and must tidy the site after the builder is finished. Health and hygiene education is conducted at each site on an individual basis once the toilet has been constructed and signed off by the Quality Assurance officer.

Figure 25: Designs used in Msunduzi Sanitation Programme Wards 6 and 7

Project Costs

The 2008 costs for VIP construction per unit are shown in Table 33.

Table 33: The capital cost summary of VIP construction (includes labour and materials) per unit in Ward 6 & 7, Mzundusi Municipality, KwaZulu-Natal

No.	Item	Cost 2006 (R)
1	Labour and Transport	897
2	Materials	2153
4	Site Establishment	255
	Total	3305

Operational History

It is too soon for the Msunduzi Municipality to have had to empty any pit toilets. However, it is of concern that as yet this municipality has no policy, budget or capacity for doing so.

4.2 Urine Diversion Systems (UDs)

4.2.1 eThekwini Municipality, KwaZulu-Natal

Project Background and Implementation

In 2000 the eThekwini municipality boundaries were demarcated. This increase in the population size served by the municipality meant that there were an estimated 200 000

families without access to adequate sanitation. For communities living beyond the urban edge, a solution was required that:

- was cost competitive to construct and maintain
- could be emptied by households themselves or by others at an affordable cost
- was environmentally sustainable
- matched the available water supply and preferably required no water at all to operate effectively
- was acceptable to the communities who use these toilets.

The option selected by the municipality for those communities with a low population density was a double pit urine diversion toilet (Macleod, 2005). Over 60 000 of these double pit latrines had been constructed by December 2007. Figure 26 shows the double pit urine diversion latrine constructed by the eThekwini municipality.

Each household is visited 5 times by the eThekwini Water Services health and hygiene education team. The first visit is to inform the householder on the plans to provide water and sanitation and to collect information on the household to assist in planning i.e. are there disabled people in the household who require easier access to the toilet. The second visit is about health and hygiene, the third visit explains how the urine diversion toilet works and the fourth concentrates on information about water supply. The final visit focuses on operation and maintenance and the householder is supplied with the equipment to empty the toilet vault (WIN-SA, 2006).

Figure 26: Outside and inside views of the eThekwini double pit Urine Diversion toilet

Project Costs

There is no community involvement in the actual construction of the urine diversion toilets and pit emptying is the responsibility of the householder. The cost of constructing a double pit urine diversion toilet, shown in Table 34 is R5 414 excluding VAT in 2008 Rands, excluding management and ISD costs.

Table 34: Capital costs per unit for UD toilet constructed by eThekwini Municipality

Item	Cost 2008 (R)
Labour	896
Materials	4 517
Total	5 414

Operational History

6000 urine diversion toilets were built in the Mzinyathi district of the eThekwini municipality in 2002-2003. There is currently a rehabilitation programme in the area being carried out on the first phase toilets built as the design has been changed. The rehabilitation consists of the pit chamber cover being changed from concrete slabs to sliding plastic doors for easier access, a cap and fly screen being attached to top of vent pipe, the toilet door being changed and the householder being provided with a rake to spread out waste in the chamber.

In general the urine diversion toilets of the households visited were found to be well maintained, an example of which is shown in Figure 26 (left). However, toilets were seen which were not being used by the householders. Some of those questioned said that the pits were too small, and for that reason they were not using them. For example Figure 27 shows a urine diversion toilet being used to store mattresses and Figure 28 a situation where the householder continues to use the old latrine.

Figure 27: UD toilet with missing door being used for storage

Emptying of urine diversion toilets is not provided for by the municipality, whose policy is that the emptying of the toilet chamber is the responsibility of the householder. This is communicated to the recipients of urine diversion toilets before they are constructed on their property. In a survey carried out by the municipality it was found that 70% of householders were prepared to empty the toilets themselves and the remainder were willing to pay for someone to do it for them. The pit volume of each chamber is 0.7m^3. The market rate for pit emptying is currently thought to be in the region of R65 per chamber (as at January 2009). Depending on the number of users each pit would need to be emptied every 2-5 years. The dehydrated faeces from the chamber can be safely buried on site.

Figure 28: New UD toilet on the left but the householder continues to use the old latrine on the right and uses the UD toilet on the left for storage

It is still early to make a conclusive assessment of how readily users of the eThekwini UD toilets will take care of the emptying of their pit vaults, but six years after the commencement of the programme the municipality has not been required to intervene in pit emptying.

4.2.2 Ducats, Buffalo City, Eastern Cape

Project Background and Implementation

The project was implemented by the Amatole District Municipality to address the acute need for sanitation in an informal settlement of approximately 650 households. It was not feasible to install water-borne sanitation, and a low cost housing development was planned for the area at a later date, which was to be part of the roads, water, and sanitation and electricity infrastructure. The intention was and is that the informal shacks be demolished upon completion of the formal low-cost housing estate. During the implementation period from March 2001 to January 2002, 615 Enviro Loos were installed in the settlement.

Demonstration units were constructed and the community were assisted in the maintenance of the toilets for about 6 months. The community provided limited labour to the project. Health and hygiene education were not part of the project. An example of an Enviro Loo at Ducats is shown in Figure 29, left.

Project Costs

The project was initially funded by the Cape Provincial Administration prior to transfer from the District Municipality to the Local Municipality, after which the project was funded by CMIP (i.e. DPLG). The overall cost was approximately R2 970 in 2001 and at 2008 prices would be R6 205 per unit. The breakdown of these costs is shown in Table 35.

Table 35: Breakdown of project costs per Enviro Loo installed at Ducats

Item	Cost 2002 (R)	Cost 2008 (R)	Description
Enviro Loo	2 176	4 914	Supply of unit, contractor training and user education
Labour	794	1 291	Excavation, Construct slabs, erect unit.
Total	3 300	6 205	

Operational History

The toilets investigated at sanitation project at Ducats were generally dirty, fly infested, and smelt unpleasant. In some of the Enviro Loos the boxes where dehydration of the faeces takes place had large quantities of liquid in them which was reportedly due to the ingress of rain and groundwater. A few households had “paired” resources; all using one toilet until the box is full, then using the other, allowing a period for dehydration and composting to occur. These were households which consisted of people less than 35 years of age, and where the combined maximum number of users did not exceed 6.

The residents disposed of waste from the Enviro Loos in the bush-filled valleys (Figure 29, right). These are steep-sided valleys leading into the Nahoon River, only a short distance from the tidal estuary, where evidence of this in the form of environmental pollution is evident after heavy rain. Residents reported community unrest over the actions of some other residents that deposited their sludge at the roadside in front of their houses. The reported motivation to do so was to coerce the Municipality to undertake the removal of the sludge.

Figure 29: Enviro Loo (left); valley where residents have disposed of waste from the Enviro Loos (right)

Clearly these toilets are not being used in accordance with manufacturer's specifications or design. At present, no cost is being incurred for operation and maintenance in terms of municipal budget.

It was noted that materials used for anal cleansing varied greatly, exacerbating the problems of non-decomposition. The process of establishment of toilets preceded the construction of housing, and currently there are over 200 households in shack dwellings for whom there are no toilets at all. The very high density of toilets results in what residents have described as a "smelly cloud" which hangs over the settlement on hot days, and which makes the environment most unpleasant.

The extreme negative perception of the residents presents a huge obstacle to sustainability. This negative perception commenced with the extended arguments between supplier, contractor and consultant during the construction phase. The residents' view is that "if the professional team are arguing over this kind of toilet, we don't want it". So they started off negatively. This was made worse by their experience: the toilets have not been installed or operated in accordance with the manufacturer's instructions, resulting in toilets that smell, boxes filling up much quicker than anticipated, and a multiplication of flies.

The toilets, mainly through misuse, are not performing as was promised to the community and this has exacerbated the negative perception. When the boxes need to be emptied, there is no municipal service to remove the waste, most of which is not decomposed, because it contains foreign material such as cement pockets, rags, sanitary towels, plastic bags, bones, rocks, etc. The perception from the community is that "if the municipality do not want to help us, these really are unacceptable toilets."

Any attempt to enhance the sustainability of this sanitation service will have to address the following:

- The proper functioning of the toilets according to the manufacturer's specifications.
- The long term education of the residents to change their perceptions and practices.
- The formal co-ordination of the waste disposal / composting process.

4.2.3 Bereaville, Theewaterskloof Municipality, Western Cape

Project Background and Implementation

Bereaville is a rural settlement with 348 households situated on the edge of Genadendal in the Western Cape. The area is characterised by extremely hot summers and very cold and wet winters. During these hot dry summer months there are often water restrictions and the flush toilets fail. Bereaville can also not be economically connected to the wastewater plant in Genadendal. Before implementation of the project some of the community households were still making use of the bucket toilet system, which was expensive for the municipality to maintain. As a result of these factors, the Theewaterskloof Municipality installed two demonstration Urine Diversion Sanitation (UD) systems in the community in 2003 to test the acceptance by the community. A section through the UD is shown in Figure 30. At the time of the field visit the demonstration units had been in use for one year and were generally accepted by the households and the community as a whole. The aim of the installation of the UD system was to eradicate all bucket toilet systems that were in use in the area. From May 2004 to December 2004, 71 bucket toilets (including two demonstration units) were replaced with UD toilets.

A composting bin was constructed with each UD toilet. The solids can therefore be deposited into the composting bin along with any other organic matter to be used for the making of compost as the owner sees fit. The urine is diverted away from the toilet into a soak away. All UD toilet pits were fitted with a circular 45 litre plastic bucket beneath the toilet pedestal. Filling of the buckets varied according to the number of residents per household. For example a household of three emptied the bucket once every month, and a household of six emptied the bucket once per fortnight. The 45 litre plastic bucket placed beneath the pedestal catches all the solids and it also meant that no direct contact would be made with any solids as the bucket could easily be removed by hand. When the solids are deposited into the bucket, the users cover them with ash or dry sand. This method is used

for drying out the solids as quickly as possible to avoid any odours. The householder is responsible for all maintenance and emptying.

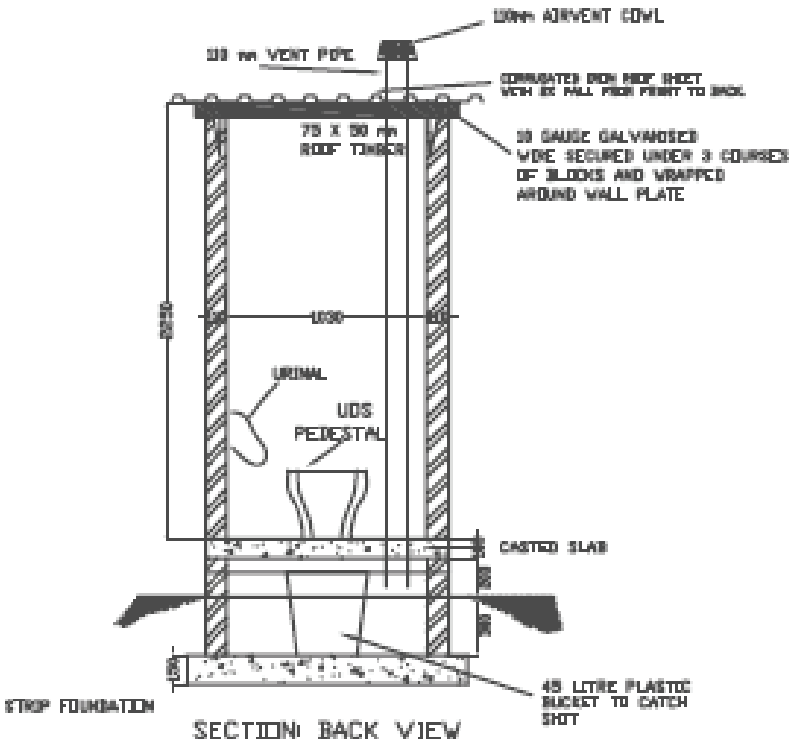

Figure 30: Back view of a section through the urine diversion system used at Bereaville, Theewaterskloof Municipality, Western Cape

The community assisted in the allocation of the households where the toilets were to be constructed. They also assisted in the building of structures as well as the building quality monitoring and health awareness training. Local builders with previous building experience and qualifications were used for construction. All builders had to attend a training workshop before construction commenced. Members of the community also attended various sanitation workshops held in the community as part of the project.

The health and hygiene education was provided by Evelyn Oppelt of E&E resources. She also formed an Awareness Team using five local residents and educated them in the use of the UD system. The Awareness Team members then educated the community by means of house to house visits and community workshops. The awareness programme proved to be successful as the majority of toilets as at January 2006 were in good condition.

Project Costs

All funds for the project implementation were made available by NORAD, a Norwegian aid organisation. No financial contributions were made by any community members and no labour was donated. The recipients however had to maintain their structures once handed over to them and they were encouraged to attend training workshops. The breakdown of the costs per unit constructed are shown in Table 36.

Table 36: Breakdown of project costs per unit in 2004 for Bereaville UD toilets

Item	Cost 2004 (R)	Cost 2008 (R)
Materials	4 237	5 941
Labour	929	1 283
Training	592	818
Total	5 758	8 042

Operational History

As individual households received UD toilets, the responsibility of cleaning and maintaining of the toilets were given to the households. The Awareness Team then made regular house visits and inspected all toilets. At first some residents weren't using the toilets correctly, but by the third monitoring visit, it was noticed that most residents were maintaining their UD toilets.

Only two of the nine households that were interviewed used their composters (most householders were not at home as it was harvest time during the site visit). As of yet no one has used the compost for fertilising purposes. An example of a composter at Bereaville is shown in Figure 31 (left).

Four out of the nine residents visited were not using soil or ash to cover the solids. The main reason residents gave for not using ash or soil was that they forget to put a bucket with ash or soil in the toilet. The toilets that are currently in use are being used frequently according to the households. Five to six residents on average use a toilet and the bucket typically gets emptied two times per month. The solids are put into the composter or buried.

Figure 31: Composter at Bereaville, Western Cape (left); blocked urinal (right)

During the site visit it was found the system was working very well in the area. Some problems have arisen with the UDs and they can be summarised as:

- Urinal is blocked (Figure 31, right)
- Composters has no lids
- Toilets smells of urine

On investigation it was found that the problems were due to the households not using their systems correctly. It was recommended by some of the community members that follow-up workshops which focussed on user education and hygiene were required.

4.2.4 Koel Park Sanitation Project, Boland District Municipality, Western Cape

Background and Implementation of Project

Koel Park is an informal settlement with approximately 200 residents (30 families) situated near Stellenbosch. The area has a high rate of unemployment. The informal settlement is situated on private property, and therefore, permanent structures have not been constructed. Sanitation in Koel Park was limited so the Boland District Municipality used emergency funds to construct 15 UDs toilets in August 2004. Although the municipality refers to the toilets constructed at Koel Park as VIPs they in fact function in the same way as a Urine Diversion System does, by separating the solids from fluids. There was one toilet provided for every

two or three families, and operation and maintenance was the responsibility of the residents once construction was complete.

The community had no involvement in with the construction of the toilets which was carried out by the Boland District Municipality Road Maintenance Team. Also no formal health and hygiene education was carried out in the area according to the local residents. Some user awareness training was conducted during the construction of the system.

Project Costs

All funds for the project were made available by the Boland District Municipality. The Boland District Municipality stated that one unit cost R2 335 (in 2004 Rands). This figure does not include labour as employees of the Boland District Municipality Road Maintenance Team were used to construct the pits. In calculating the cost of construction at 2008 prices (Table 37) an inflation index was used from Statistics SA to escalate material costs and the management and an estimate was made for the labour cost.

Table 37: Summary of cost per unit for Koel Park sanitation project

Item	Cost 2004 (R)	Cost 2008 (R)
Labour		350
Materials	2335	3 208
Total	2335	3 558

Operational History

The recipients had to take full responsibility for the toilets once construction was completed. The toilet structure has a tank at the back, which can be filled with water if the system is connected to a sewer and the latrine can then be converted to a flush toilet. However, this area is not connected to the sewer line but residents filled the toilet with water as they thought it was a flush toilet. This resulted into the toilets becoming unhygienic and made the use of the system unpleasant.

Figure 32: Example of the toilets at Koel Park near Stellenbosch

Because the system was shared between families, the pits filled up quite quickly (less than 6 months). As the pits filled up they were not emptied and were just left standing or even demolished. The residents then reverted back to the bucket toilet system they previously used. Clearly the user training did not communicate well enough how to manage and operate this type of sanitation system.

The residents of Koel Park are very unhappy with the system installed; they were under the impression that this was a water-borne system and therefore treated it as such. According to them it was no different to a bucket system.

4.2.5 Northern Cape Sanitation, Kammiesberg Municipality, Northern Cape

Project Background and Implementation

The systems installed in the Northern Cape are single pit Urine Diversion Systems (UD), double pit UD toilets (Figure 33), single pit VIP toilets and double pit VIP toilets. The installation of waterless sanitation in the Northern Cape Project started in 1999 at Kharkhams, Kheis, Spoegrivier and Klipfontein. These villages are characterised by very hot and dry summers. Little water is available during this time and alternative sanitation services had to be provided for the community. All four areas were served with a variety of sanitation

services, which did not use water. Before these systems were installed, residents made use of bucket latrines.

The District Municipality provided a subsidy for the construction of these toilets. The homeowner could decide what type of structure they wanted. If the structure wanted by the householder cost more than the subsidy amount the householder paid the difference. Some homeowners transformed their existing bucket toilet structures into a VIP or UD toilet.

Health and hygiene education was provided by NAWASAN. Sessions were held with local residents, which then served as the awareness group in the area. The awareness group carried out house-to-house visits to the recipients of the toilet structures.

Figure 33: Double urine diversion system, with ramp, at Kammiesberg, Northern Cape

Project costs

The price breakdowns for the construction of the structures in the Northern Cape Sanitation Project are shown in Table 38. The Stats SA inflation indices were used to calculate materials and labour at 2008 prices.

Table 38: The costs per unit for different UD single pits in the Northern Cape Sanitation Project

Costs	Cost 2003 (R)	Cost 2008 (R)
Materials	2 190	3 072
Labour	350	491
Total	2 240	3 563

Operational History

The toilets were handed over to the homeowners once construction was completed. The homeowners then had to take care of their structures. Most people opted for either the double pit VIP or double pit UD. Once the one pit was filled up it is left standing for up to 2 years while the second pit is filled. As the area is very hot and dry, the sludge dries quickly. The dry sludge is removed with shovels and rakes, and one householder interviewed said that she just puts on a pair of gloves and takes it out by hand.

4.2.6 Ekurhuleni Metropolitan Municipality, Gauteng

Project Background

This pilot project was funded by the Ekurhuleni Metropolitan Municipality from its own internally raised funds. The core aim of the project was to test options for basic dry sanitation services in areas without waterborne sanitation. In this case the municipality insisted that the units were sealed so that they would not pollute the groundwater. It was anticipated that a significant number of units would be used at their initial installation site for a limited period only, due to some informal settlements having to be moved and other more formal settlements being upgraded to waterborne sanitation. As a result, systems that can be easily moved to another site are also being sought. As well as evaluating the systems from the Municipalities view point, a core aim of the project is to evaluate user acceptance.

The Ekurhuleni Metropolitan Municipality area is divided in three regions: the Eastern Region, the Southern Region and the Northern Region. A study site was selected in each region and each sanitation system is being evaluated at each site, so that differences in the study sites cannot influence the final outcomes. The differences in the study sites are described in Table 39. The core implementation period was from June 2004 to May 2005.

The three systems being evaluated as part of the sanitation project are: Enviro Loo, EcoSan, and SolarSan and the installed superstructures are shown in Figure 34. All three systems

rely exclusively on the heat of the sun combined with a wind driven whirlybird extraction fan to remove odours from the toilet and dry out the faeces so that so that the resultant material can be easily and hygienically removed from the storage area at rear of the toilet. All three systems also have a lever operated mechanism to remove the faeces from toilet bowl after defecation.

Figure 34: The three dry toilets trialled by Ekurhuleni Metropolitan Municipality: Enviro Loo (left), EcoSan (centre) and SolarSan (right)

User education was limited to some basic general education and training on how to care for the latrines. The cost of the education was included in the quoted cost of the toilets. The Ward Councillors for each site were present at the majority of the education sessions for each system. The inside of each type of toilet is shown in Figure 35.

The solarsan toilet is an example of a desiccating toilet (Figure 36). It is a waterless toilet that consists of a toilet station for receiving faecal matter and diverting urine, a waste collection station for collecting the drying faecal matter, a removable bag for final disposal of the waste and an circular conduit which is a drying passage. A conveyor inside the housing is used to remove the faecal matter. A wind turbine powers the ventilation system which moves ambient air through the pedestal, into the housing and through the sump (Solarsan, 2005).

Figure 35: Inside of the superstructures: Enviroloo (left), EcoSan (centre) and SolarSan (right)

Figure 36: Solarsan toilet installed near farm worker accommodation near Howick, KwaZulu-Natal

Table 39: Ekurhuleni sanitation study site descriptions

	Eastern	Southern	Northern
Site name	Mayfield	Sakhile	Freedom Square
Area name	Daveyton	Katlehong	Tembisa
Site description	Formal	Semi-informal	Informal
No. households	254	630	520
Area hectares (ha)	8.0	15.0	3.2
Density households per ha	32	42	162
Planned no. toilets	72	273	141
No. households per toilet	3.5	2.3	3.7

Project Costs

The suppliers of the sanitation systems were responsible for installing their own systems using unskilled labour residing at the site where the particular toilets were being installed. The municipality required labour to be paid at a flat rate of R65 per day and initially this worked satisfactorily but as work progressed, and those employed noted the short-term nature of the project, productivity fell sharply. The municipality then agreed that the labour could be paid on a production basis, provided the input times required to do the work would result in the minimum rate of R65 per day being achieved by each labourer. The result was labourers earned close to R200 per day. The cost of each sanitation option used in the pilot is shown in Table 40.

Table 40: Ekurhuleni costs per unit for each sanitation option at 2008 prices

Item	Enviroloo (R) 2040 model	EcoSan (R)	SolarSan (R)
Toilet inc. superstructure	7 768	5 684	6 899
Labour	1 067	975	1 147
Total	8 835	6 659	8 046

Operational History

It was planned that multiple households would use each toilet. However, after a very short time period most toilets, especially at the Mayfield and Sakhile sites, were only being used by one household. Reasons given for this outcome were as follows:

- Most households objected to the concept of sharing a toilet with other households
- The objections to the concept of sharing were made worse over arguments as to who was responsible for ensuring that the toilets were kept clean
- At Mayfield and Sakhile where toilets were installed in households' yards, the other households could not use the toilets because many of the 'controlling' households had gates that prevented access to their yards or they purposefully put locks on the toilets to prevent the other households gaining access.

In Freedom Square individual households did not control the toilets. This was because, due to crowding, the toilets were installed on common ground at the edge of the settlement. Then to share the load on the individual toilets and on the different toilet systems, each family was given a key to a specific toilet. Blockages have occurred with all the sanitation options (Figure 37) and can be attributed to heavy use, incorrect use, and problems with the flushing mechanisms.

The aims of the pilot study were to assess the efficiency and effectiveness of the technology and evaluate user acceptance. It did not extend to evaluating sustainability issues and therefore no funds were made available for emptying the toilets. Initial assessments of the project reveal that the Enviroloo toilet to be the most robust and require less maintenance compared with the other two options.

Figure 37: Toilet blocked with newspaper EcoSan (left), SolarSan (right)

4.3 Waterborne Sewerage

4.3.1 Waterborne Sewer Reticulation – Ntuthukoville, KwaZulu-Natal

Project Background and Implementation

The community now known as Ntuthukoville (formerly Happy Valley) is located 5km from the Pietermaritzburg city centre, adjacent to the suburb of Woodlands. The settlement was started by families who had fled the factional fighting in the Table Mountain area of KwaZulu-Natal in the late 1980s. The families settled on a strip of steeply sloping land between the tarred road to Otto's Bluff and the railway line. In 1995 the settlement had only emergency services.

The Built Environment Support Group in conjunction with the Ntuthukoville Development Trust coordinated the upgrading of the existing informal settlement in conjunction with the local authorities and the provincial housing department. The upgrade included the subdivision of the settlement into regular plots, the construction of roads, stormwater, water, sewage and electricity services. This case study covers the sewerage reticulation only. The house connection detail used is shown in Figure 38.

Full waterborne sewerage facilities and a connection to the existing sewer were provided by the municipality. The number of households to receive waterborne sanitation was 164 with the number of persons per household being on average 6. The main sewer collector through Ntuthukoville was also required to be able to carry an additional flow from 250 households from an adjacent settlement should the municipality decide to install waterborne sewage there in the future. The toilet block with outside tap and sink are shown in Figure 39 (left).

Project Costs

The breakdown of project costs are show in Table 41, the 1995 prices for materials and labour have been escalated to 2008 (the 2008 costs were calculated using inflation indices from Statistics SA). The total cost per household at 2008 prices was R8 921. This cost includes the cost of the sewers and the bulk collector up to the boundary of the Ntuthukoville settlement, but excludes the costs of any bulk sewers or treatment plant downstream (no expenditure was required in this case, but where bulk capacity is lacking very substantial expenditure can be required). Like the other costings in this chapter, it does not include contractor's overheads and professional fees.

Table 41: Estimated cost of sewer reticulation per plot at the Ntuthukoville sanitation project (labour and materials costs only)

	Sewer Reticulation		
Item	**a) Collector line**	**Expenditure 1995 (R)**	**Expenditure 2008 (R)**
E1	Site Clearance	2.0	4.94
E2	Excavation & Backfill	173.6	426.53
E3	Extra – over E2 for intermediate	0.1	0.26
E4	Extra – over E2 for hard rock	11.7	28.73
E5	Selected Bedding, Side fill & Blanket fill	10.0	24.57
E6	160mm dia. uPVC Mainlite pipe	96.0	235.82
E7	Manholes additional to reticulation	62.0	152.36
E8	Steel pipe for exposed section	23.4	57.46
	b) Reticulation		
E9	Site clearance	10.9	26.78
E10	Excavation & backfill	390.4	959.27
E11	Extra – over E2 for intermediate	0.5	1.17
E12	Extra – over E2 for hard rock	0.7	1.69
E13	Mainlite/Corflo uPVC sewer pipes	271.0	665.86
E13a	1) 110mm dia.		
E13b	2) 160mm dia.		
E14	105mm dia. Precast manholes all depths	408.0	1002.43
E15	Rodding eyes	48.2	118.43
E16	Selected bedding, side fill & blanket fill	5.1	12.48
E17	Break into and connect to existing manholes and replace benching & channelling and make good	9.1	22.36
E18	Site connection (inc. fittings to pan, excl. 110mm pipe)	284.6	699.27
E19	Commissioning (prov)	69.8	171.47
E20	Cistern & pan	239.9	589.42
E21	Block toilet structure	1075.8	2643.29
E22	Water connection to toilet, with wash trough	438.0	1076.14
	Total	**3 631**	**8 920.60**

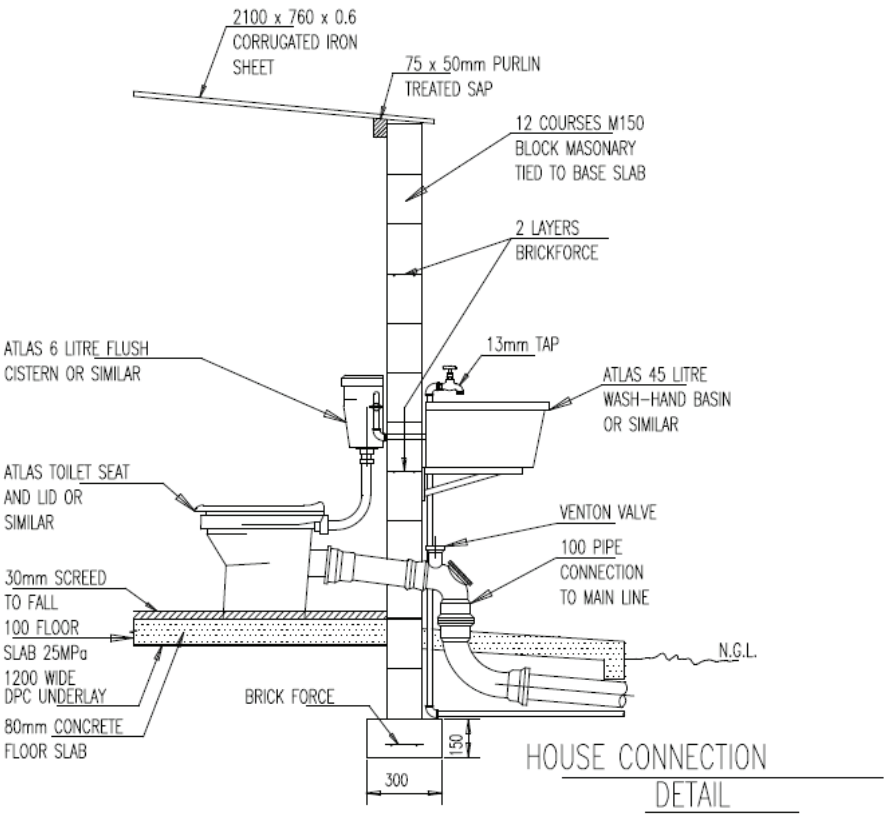

Figure 38: Schematic diagram of household connection design detail for full waterborne sewage at Ntuthukoville, Pietermaritzburg

Operational History

According to the residents of Ntuthukoville the waterborne sanitation has been well received and has worked well, with only the occasional blockage in the sewer which the municipality unblocks. On the negative side are the high water bills that some residents have incurred (the person interviewed, a community leader with a good job, has R17 000 in arrears owed to the municipality, and says that arrears of more than R30 000 are not uncommon in the community). Each plot at Ntuthukoville is metered individually.

Figure 39: Toilet block for waterborne sanitation at Ntuthukoville (left); toilet block on the left hand side of the building has been incorporated into this house so the toilet is now indoors (right)

Originally the toilet block with wash basin was built away from the residents houses. Some residents have upgraded their house and have incorporated the toilet block into the house, an example of this is shown in Figure 39 (right).

4.3.2 Boland District Municipality Farm Dweller Sanitation

Project Background and Implementation

The project, which began in 2000, is a subsidy based scheme that uses levies to subsidise the construction of latrines, kitchen and bathroom facilities. The Boland District Municipality advertises annually in the local press and with farmer organisations. Farmers can apply for the subsidy to supply their workers with sanitation and water. The subsidy is limited to R25 000 per farm and R5000 for each household. The forms are submitted to the district municipality where they are assessed and cross referenced with previous years' allocations. A business plan is produced detailing the allocation per farm. The quantities are often reduced as more applications are received than can be funded. The business plan is approved by the Executive Mayor, the Deputy Executive Mayor and the Municipal Manager. Once approved a letter is sent out to the farmers detailing their subsidy allocation and stating the conditions of the subsidy. The following are the conditions of the subsidy:

1) All work has to be completed within 6 months after an agreement is made in writing between the council and the farmer
2) The farmer takes responsibility to care for and maintain the toilet for three years after completion. Farm workers are also to occupy these houses for that specific time.

3) The farmer only receives payment on completion and after inspection by the relevant municipal health organisation. The Billing Control Officer of the Bereaville Municipality had to declare the structure acceptable after completion.
4) The municipality provides health and hygiene awareness training for all farm workers benefitting from this scheme. They also educate the farm workers regarding correct toilet usage.
5) The farmer has to supply the council with levy payment numbers before receiving any funds from the municipality. If it is found out that he has not paid or is behind on any levy payments for farm workers, this must be corrected before the subsidy can be paid.
6) All building has to be done according to the building regulations act (Act 103 of 1977)
7) A municipal building inspector has to approve the structure before the subsidy is paid to the farmer.

Most farmers preferred installing waterborne toilets, as the perception is that they are easier to maintain. Some farmers also upgraded outside toilets to inside toilets. The only farmers that applied for VIP toilets were from farms in the Karoo and other very dry areas.

The Municipality received many applications, but all could not be served. 200 applications were received in 2005/2006, but only 125 farms were granted subsidies. Some farmers were also not interested in the subsidy as they are wary of having government subsidised infrastructure on their land. Table 42 shows the completed structures between 2000 and March 2004 according to the survey done by Makhetha Development Consultants.

As this was a subsidy provided by the Boland District Municipality, the farmers had to pay for any additional work, should the cost of the structures exceed the subsidy amount. Mostly, the infrastructure was constructed by the farm workers during off season periods but some farmers employed contractors to do the work. The farmer interviewed estimated that the subsidy covered about 25% of the costs.

Table 42: Number of completed structures funded by subsidies for farm workers

Structures	Number completed
VIPs	87
Bathroom + Toilet	1698
Flush Toilets	232
Water over sink in Kitchen	1668

Health and hygiene education was provided by the municipality as part of the project. The use of the toilets is especially important as blockages can occur when not used correctly. Health and hygiene awareness was carried out by four people (an ex-farm worker, an ex-teacher, a community worker and a part time police officer), each covering a different area. R170 000 was been spent on awareness in the six months up to July 2005. Every farm that received a subsidy was visited by the health and hygiene team. A maximum of 3 sessions were held per farm and the awareness covered health and hygiene as well as usage of toilets. From July 2005 to December 2005, 400 sessions were held in total and these sessions were attended by ± 7000 people.

Project Costs

All funds were made available by the Boland District Municipality which they generated from the Regional Services Levies. Makhetha Development consultants carried out a survey on work completed up to March 2004 and it was found that ±R7 723 668 had been spent on the project. During this time 608 farms have been subsidised at an average of R12 700 per farm. The amounts made available per household for the different systems provided by the Municipality are shown in Table 43.

Table 43: Boland District Municipality subsidies for farm water and sanitation services

Item	Costs (2004 Rands)
Running water over sink in kitchen	1000
Construction of bathroom with sanitation facilities	4000
Supply flush toilet only	1600
Supply VIP latrine	1000
Electricity	1000
Warm water	1000

Electricity and warm water subsidies have been stopped as there is an ESKOM subsidy that can be claimed by farmers for connecting their workers to the electricity grid.

Operational History

All farm owners were required to maintain the toilets. Most farmers opted for waterborne toilets. The filling rates of the VIPs were not available.

Some farms have operation and maintenance problems related to incorrect use of the toilets. Toilets that open into the house are better than those that are outside as the householder

has more control (Figure 40). Farms close to the towns often have many visitors and where more people use the toilet there is greater incidence of blockages.

Figure 40: A well maintained indoor waterborne toilet on a Boland farm

4.3.3 Kayamandi near Stellenbosch

Project Background

Kayamandi is a densely populated informal settlement situated near Stellenbosch in the Western Cape. The municipality has responded to the need for sanitation by supplying each of the seven zones in Kayamandi with either one or two blocks of waterborne toilets (Figure 41, left) connected to the main sewer line. In total 70 toilets have been installed. Five families are allocated one toilet between them. The family sizes can vary and in some cases it was noted that as many as 50 people use one toilet. The municipality has appointed a cleaning team (8 members), which includes a supervisor, that clean the outside of the toilets. This cleaning team has been in place since the project started in 1993. The householders are responsible for keeping their toilet clean.

The municipality began user education in February 2005 as they were experiencing frequent blockages on the sewer line; however, since the user education began fewer blockages have occurred. The user awareness sessions are reactive as opposed to proactive i.e. awareness is carried out with those households where blockages have occurred and are not general open community sessions.

Project Costs

The cost of a block of 10 toilets was R75 000.00 as at March 2006; R65 000 for construction and materials and R10 000 for connection to the existing sewer line. Therefore, the costs per unit are R7 500 in 2006 Rands (approximately R10 000 per unit in 2008 Rands). The salaries of the cleaning team and supervisor as well as general operation and maintenance are paid for by Stellenbosch Municipality at a cost of R700 000 per year. Unblocking of pipes or toilets is budgeted for separately. The cost of the user education at the time of the study was R100 000.

Operational History

Households that share a toilet are responsible for cleaning their designated toilet but this can result in problems (Figure 41, right). Some of the residents are not satisfied with the system since difficulties exist with communal use in the following ways:

- Cleaning
- The volume of people that need to use each toilet (up to 50) particularly at peak hours i.e. early morning
- The distance of the toilet from some of the houses

Figure 41: Block of waterborne toilets in Kayamandi (left), an example of communal waterborne sanitation where there is no defined person to clean (right)

4.3.4 Temporary Sanitation at Informal Settlements, Cape Town

Project Background and Implementation

This case study considers sanitation for several "temporary" informal settlements in the Cape Town area. Some of the settlements are a few months old, but others have been in existence for as much as 25 years. Five temporary informal settlements were visited in Cape Town and the sanitation provision by the municipality was assessed.

Temporary sanitation in these settlements is communal. The five temporary informal settlements visited were as follows:

- Cuba Heights
- Village Heights
- Red Hill
- Mountain View and,
- Masiphumelele School field

To establish sanitation in an informal settlement the Cape Town municipal representatives meet with the locally recognised community leadership. The community leadership choose the location for the toilet blocks and which households will share with each other. The city aims for a ratio of 4 to 5 households per toilet but in some places there is 1 latrine to as many as 10 houses. The ratio for households per toilet is shown in Table 44.

Table 44: The number of households per toilet in temporary informal settlements, Cape Town

Settlement	Households	Implemented	Ratio (household/toilet)
Cuba Heights	52+65	2005	4 to 1
Village Heights	600	2006	4/5 to 1
Red Hill	265	2004	5 to 1
Mountain View	110	1994	2.5 to 1
Masiphumelele	260	34 (1990's) + 19 (2004)	5 to 1

The municipality made a political commitment to eradicating all informal settlements by the end of 2006. As a result there was a reluctance to invest further in services for informal settlements.

At the time of the study there had been no health and hygiene education carried out at the temporary informal settlements. This had been identified as a critical activity and although extensive planning had been done by the health department of the municipality over the previous 18 months, nothing had as yet been implemented.

Project Costs

All funding is from the municipal budget. The cost of each sanitation option per unit is shown in Table 45.

Table 45: The capital cost of sanitation options per unit for installation in temporary informal settlements, Cape Town

Toilet type	Project Date	Original Cost (R)	Cost 2008 (R)
Container	2005	1 800	2 448
Chemical	-	Hired	-
Pour flush	2005	2 700	3 673
Full flush	1994	2 850	7 596
UD	2004	3 950	5 532

All toilets are supplied and installed through tenders managed by city. The cost for full flush option also includes the cost for five metres of sewer, but not for the sewerage network beyond that. The operational costs, where known, are shown in Table 46.

Table 46: The operational costs of sanitation options per unit in temporary informal settlements, Cape Town

Toilet type	Operational Cost (2006 Rands)
Container	R70/service, 3 services per week by contractor
Chemical	R90/month contractor (excludes treatment costs)
Pour flush	Covered by sewer network
Full flush	Covered by sewer network
UD	R235 every 8 months by contractor

Operational History

The container toilets placed in the temporary informal settlements have a capacity of approximately 60 litres, and are emptied once per week. In some cases the containers are overfull at the time of emptying and residents complain that the people doing the emptying then pour some of the contents onto the ground in front of the toilet. To empty the toilets

the containers are removed and replaced with a clean and sanitised container. The containers are carried by hand to a truck where the container is emptied and then placed on the truck. The sludge is transported by truck to the waste water treatment plant where it is disposed of into a specially designed facility that has washing facilities for the workers.

Cuba Heights – Shared Chemical and Pour Flush Toilets

The chemical toilets had been vandalised and dumped in a pile on the edge of the settlement. The pour flush latrines varied in condition but generally the toilets that were within the housing blocks were well maintained but those that were accessible from the street were in a poor condition. There is also weekly solid waste collection. Latrines were shared by four families but some areas were not yet served and all the residents used one toilet. Many people used a bucket at night and then emptied these into a toilet in the morning.

Village Heights – Shared Container and Chemical Toilets

An example of the shared container and chemical toilets are shown in Figure 42 (left). Some groups of four households had locked the latrines and these were in better condition than those that had been left open. One respondent says she uses a bucket inside her house and then empties it into the toilet rather than using the container toilet which she thought was a health risk.

Red Hill – Shared Urine Diversion Toilets

All the toilets visited were full and overflowing. The toilets had been emptied once before but by a private company contracted by the municipality. The community no longer used the toilets but used the bush around the settlement. Some people had built their own toilets an example of which is shown in Figure 42 (centre).

Mountain View – Flush Public Toilet

The toilets were generally in a good condition, as shown in Figure 42 (right). A local service provider cleaned the communal latrines daily and some of the latrine blocks were locked by the users.

Figure 42: Shared chemical toilet in Village Heights (left); toilet constructed by local resident in Red Hill (centre); flush communal toilet, Mountain view (right)

Masiphumelele School Field – Shared Flush Toilets

Those that were locked were in good condition but the open latrines were filthy. The drain was leaking and a pool of raw sewerage had collected in the walkway. Users were not satisfied with the latrines and felt that their complaints were not responded to.

The high level of failure of sanitation in the temporary informal settlements visited in Cape Town in 2006 can be attributed to the following:

- There was a complete absence of health and hygiene education, along with a lack of user information.
- There was no management structure to ensure that communal sanitation blocks (with 4 to 10 users per latrine) were kept clean
- With the communal sanitation blocks there are issues with security for using toilets at night

4.4 On site septic tank case study: Slangspruit, Pietermaritzburg

In the course of this project only one large scale use of septic tanks for subsidised basic sanitation has been studied. During the 1990s the Msunduzi Municipality (Pietermaritzburg) installed approximately 5 000 low flush septic tank systems in the greater Slangspruit area. During Phase 1 a one cubic metre septic tank-soakaway combination was used, which functioned much like the pit in the pour flush latrines which are used in Asia (see Figure 43, below). This was relatively successful.

Figure 43: View of septic tank/soakpit combination used at Slangspruit in early phase

During later phases the municipality, needing to save costs, followed the HS pedestal manufacturer's recommendation to dispense with the large soakpit, installing instead a stone filled trench, which is substantially cheaper. This is standard practice after properly sized septic tanks (typically 1.2 m^3 or larger for low flush toilets), but in this case the only septic tank included in the installation was the 15 litre solids interceptor which is built into the base of the pedestal (see Figure 44). Before long the new soakaways failed, which would have caused the sewers to block and the toilets to overflow. The users then either abandoned their flush toilets and constructed makeshift pit latrines (see Figure 45), or they dug open cesspits to intercept their sewage en route to the soakpit. This was clearly a most unhealthy situation. The municipality eventually found funds to appoint a contractor to go back to all the later phase toilets to construct block septic tank/soakaway combinations similar to those used in the earlier phase of the project (see Figure 43).

Figure 44: The HS Pedestal with integral 15 litre solids interceptor

Figure 45: This family has constructed a VIP for themselves (background) as their flush toilet has failed due to the inadequacy of the septic tank and soakaway provided.

The HS cistern and pan is water efficient, requiring only one litre to flush. However the flap seal leaks after some time if not maintained, and then homeowners switch to manual flushing using a bucket.

5. DISCUSSION OF CASE STUDIES

The VIP sanitation projects that formed the case studies ranged from projects that were started as early as 1995 through to some which began as late as 2006 and which are still current. Some of the case studies were from rural areas, and others from peri-urban areas. The case studies are discussed below under the following headings:

- Capital Costs
- Operation and maintenance; and
- Community participation and user education

5.1 Capital Costs

5.1.1 VIP case studies

In general the capital costs of the VIP cases at 2008 prices, excluding management costs and VAT, were in the range R2 500-R4 126. The breakdown of these capital costs into the basic components of materials and labour is shown in Table 47 below. This breakdown also shows where a portion of the costs was carried by the householders. In some cases the householders were required to contribute to the material costs (e.g. at Thembalethu, where they had to pay for the door, the frame and the lock). In all cases, except Newlands, the

beneficiaries were responsible for a portion of the labour costs, usually comprising the digging of the pit, and sometimes including the making of the blocks.

Table 47: Summary of VIP costs per unit from the sanitation case studies (2008 Rands), excluding management costs

Case Study	Labour	Sweat equity	Materials & transport	Household contribution	Total
Inadi	676	250	1 574		**2 500**
Thembalethu	186	400	1 530	500	**2 616**
Nkomazi	897	420	1 206	340	**2 863**
Newline	515	400	1 630	330	**2 875**
Mbazwana	1 416	300	974	300	**2 990**
Msundusi – Ward 7	897	250	2 408		**3 555**
Newlands	1 235		2 891		**4 126**

Notes: 1) Management costs are highly variable depending on circumstances, and have therefore been excluded.
2) To escalate to 2009 costs, a factor of 1.1 should be used.

In Table 47 the lower capital cost cases (Inadi, Thembalethu, Nkomazi, Newline and Mbazwana) were all pilot projects constructed under the auspices of the Mvula Trust in the mid 1990s. In these projects between R700 and R800 was made available as a subsidy to cover materials and labour costs. Any costs above this level had to be borne by the beneficiaries. In 2008 Rands that subsidy equates to R2 100 to R2 400, and it can be seen from the figures in Table 47 how the limiting of the subsidy either resulted in the adoption of low cost design (e.g. at Inadi, where the pit was offset with no pit lining) or in a significant contribution from the family.

By 2006 when the Msunduzi Sanitation Project commenced, somewhat higher levels of capital subsidy were available through the MIG programme and moreover in terms of government's free basic sanitation policy there is more of an expectation that householders' contributions should be limited to the digging of the pits. The higher subsidy made it possible to use a more durable door design, as well as to fully line (not seal) the pit to make future emptying more feasible.

The Newlands project was the most expensive, having been built in an emergency situation and with no requirement for a community contribution.

5.1.2 Urine Diversion Case Studies

Table 48 shows the spread of costs encountered in the urine diversion case studies, which range from R3 808 at Koel Park to R8 835 at Ekurhuleni.

Table 48: Summary of urine diversion toilet costs from the case studies (2008 Rands)

Case Study	Type	Labour	Materials & transport	Total
Koel Park	Single pit UD	600	3 208	**3 808**
Kammiesberg	Single pit UD	542	3 416	**3 958**
eThekwini	Double pit UD	896	4 517	**5 414**
Ducats	Enviro Loos	1 291	4 914	**6 205**
Ekurhuleni	EcoSan	975	5 684	**6 659**
Bereaville	Single pit UD, plus composter	1 283	5 941	**7 224**
Ekurhuleni	SolarSan	1 147	6 899	**8 046**
Ekurhuleni		1 067	7 768	**8 835**

Notes: 1) Management costs are highly variable depending on circumstances, and have therefore been excluded.
2) To escalate to 2009 costs, a factor of 1.1 should be used.

From Table 48 it can be seen that there is a wide range in possible costs for UD toilets, depending on whether the design is single pit or double pit, and whether it is made using locally available materials, or an imported proprietary system (such as the Enviro Loo or SolarSan).

Double pit urine diversion toilets are more expensive than pit latrines because they require two pits to be dug and a more sophisticated pedestal. However single pit urine diversion toilets are not necessarily more expensive.

The additional cost of constructing a UD needs to be considered in terms of the lifespan of a UD compared with a conventional pit latrine and in terms of the costs associated with emptying or reconstructing pits once they are full.

5.1.3 Waterborne Sanitation Case Studies

Waterborne sanitation is often seen as the most desirable form of sanitation from a user perspective and is generally seen as the best option in high density living areas. Unlike pit toilet systems, waterborne sanitation has a cost to the user every time the toilet is used because the system requires water to transport the waste products away.

Table 49 below provides an indication of the cost of developing waterborne domestic services but excludes bulk sewer costs and waste water treatment plant costs. It does not include the cost of the water.

Table 49: Summary of waterborne toilet costs from the case studies (2008 Rands)

Case Study	Labour/materials inc. sewer connection but excluding bulk sewer and works cost
Ntuthukoville	8 921
Kayamandi	9 360

5.1.4 Cost Summaries from Case Studies

In general the capital costs of the different technologies reviewed in these case studies were found to be in the following ranges (2008 Rands):

- VIP R2 500-R4 126
- UD R3 808-R8 835
- Waterborne R8 921-R9 360 excluding sewer and works costs.

Note that these costs exclude training, community liaison, health and hygiene education, construction management, project management and professional fees. Depending on how the project is structured, these items will add between 20% and 50% to the project cost. Other factors that affect costs are whether, for example, the pits are lined or unlined, whether very cheap but sometimes poor quality door and roofing materials are used, to what extent voluntary labour (sweat equity) is used, and so on. The earlier projects dating back to the mid 1990s were funded using a fixed subsidy of approximately R700 for labour and materials, and this tended to limit design choices and keep costs down. Since the free basic sanitation policy was adopted in 2001, however, homeowners are typically not expected to contribute more than the digging of the pit, and labour costs have risen. Also, experience has shown that it is short sighted to use the cheapest materials, especially for doors, and that the absence of pit lining can lead to the collapse of latrines.

5.2 Operation and Maintenance

5.2.1 VIP Latrine Studies

An observation arising from the studies of older VIP projects is that some pits are already full and many will soon be full. This presents some challenges to both the householder and the municipality. Once the pit is full, either a new VIP should be constructed or the existing pit should be emptied. However, most municipalities have not yet budgeted or planned to empty existing pit latrines. It is as a result not uncommon to see new pit latrines constructed alongside old pit latrines which were built in the 90s and have since filled up (see 46 below).

Figure 46: Some municipalities find it easier to find finance to build new VIPs than to implement systems to empty full latrines. In these cases the older latrines were built before the municipalities came into existence in 2000, and are typically not on their records.

The topic of pit emptying and sludge disposal is covered in Chapter 6. This discussion is limited to what has been observed in the case studies described in Chapter 4. Table 50 below provides a summary of the operations and maintenance history of each of the VIP projects visited.

Table 50: Summary of operation and maintenance of VIP case studies

Case Study	Project Date	Ongoing Operation & Maintenance	Problems
Inadi	1995	Municipality currently does not have any plans or budget for pit emptying. 25% of toilets have been replaced.	After 11 yrs 55% of toilets are full.
Mbazwana	1995	Municipality currently does not have any plans or budget for pit emptying.	5 out of the 25 toilets inspected had collapsed, but no full pits observed
Newline	1995	No pits full after 11 years; the municipality does not offer a pit emptying service.	None
Thembalethu	1995	Twin pits toilets. Waste removed every two years by householder & composted or discarded	Poor quality construction, some unhygienic toilets
Nkomazi	1995	Maintenance responsibility of householder; municipality currently does not offer pit emptying service	A small number of pits are reported to be full
Newlands	1998	Municipality emptying with vacuum tanker, but presence of solid waste a problem	Communal VIPs filled quickly & unhygienic; superstructures damaged
Msunduzi	2006	No operational plan, although toilets designed in such a way as to allow mechanical emptying	

In the case of the Inadi project the percentage of full pits was significant (55%) but these were relatively small pits (1.8 m^3). The Inadi design makes use of an unlined pit which is offset from the top structure. In the case of Newline, in contrast, large lined pits (approx 5 m3) were built and not one was full after 11 years.

Thembalethu is perhaps the most interesting case, because at the time of construction there was some scepticism that a double pit VIP project would work out as planned. In this small Eastern Cape village, very shallow soil depths prevented the construction of large pits, and as a result a twin pit design was adopted, with each pit having a volume of 0.8 m^3. A pit is used for two years, then closed while the second pit is used. At the end of the fourth year the original pit is emptied. This has been done by the Thembalethu home owners without municipal assistance.

5.2.2 UD Case Studies

The main problems associated with the UD toilets are incorrect use and maintenance. Some of this is attributed to insufficient user education. The problems experienced at Ekurhuleni and Koel Park were largely attributable to the toilets being communal. There was a lack of clarity amongst the residents over responsibility for the toilets and subsequently they are being poorly maintained. Urine Diversion or UD systems go some way to addressing the operational costs associated with emptying pit and double pit latrines. UD

systems however require more user education and more frequent maintenance than traditional pit latrines. Table 51 summarises the findings from the case studies.

Table 51: Summary of operation and maintenance findings from UD case studies

Case Study	Project Date	Ongoing Operation & Maintenance	Problems
Ducats	2001	Householders responsible for emptying	Toilets not used according to manufacturer's specifications resulting in unhygienic toilets. Toilets very unpopular.
eThekwini	2002	Householders responsible for emptying; municipality refurbishing some toilets due to design change	Some families still sceptical and not using new UD toilets
Kammiesberg	2003	Householders responsible for emptying and maintenance	None reported
Koel Park	2004	Communal latrines – maintenance responsibility of residents	Toilets not used correctly due to lack of user education. Toilets very unpopular and abandoned
Bereaville	2004	Householders responsible for emptying and maintenance	Generally good, but not all residents using ash or sand; composters not being used; some blocked urinals
Ekurhuleni	2004	Communal latrines – maintenance responsibility of residents	Communal usage highly problematic

The key conclusions that can be drawn are as follows:

- Individual responsibility is critical to the success of UD systems. They should not be used communally (i.e. by more than one family).
- User education and follow up training is critical to UD success
- If UD systems are owned by families who use them properly, they are successful and can be easily looked after by the householders, relieving the municipality of the ongoing maintenance burden.

5.2.3 Waterborne Case Studies

As with any waterborne system, operation and maintenance of the sewer system remains the responsibility of the municipality. Unlike other sanitation systems, waterborne toilets have an ongoing operational cost and some users are incurring high water bills, which are in many cases not paid. Table 52 below summarises the observations from the waterborne sanitation case studies.

Table 52: Summary of operation and maintenance findings of waterborne sanitation case studies

Case Study	Project Date	Operation & Maintenance	Problems
Farm Dwellers, Western Cape	2000-2005	Responsibility of farm workers/owner; septic tanks emptied by municipality	Some toilets used incorrectly; some blockages
Mountain View, Cape Town	1994	Local cleaning service in some areas in other areas none	In area with no cleaning service the communal toilets are unhygienic
Ntuthukoville, Pietermaritzburg	1996	Occasional blockages in system which municipality clears	Residents incur high water bills, and municipality has accumulated bad debt
Cuba Heights, Cape Town	2005	Operation and maintenance is the community's responsibility	Problems with safety when using communal toilets at night
Slangspruit, Pietermaritzburg	2006	Municipality empties septic tanks when required	In many cases the septic tank or soakpit has failed and larger septic tanks have had to be retrofitted.

5.3 Community participation and user education

User education (which includes health and hygiene education) is a feature of the VIP projects studied (Table 53). All the VIP projects studied, with the exception of the Newlands sanitation project in Buffalo City, had user education built in to the project costs.

The projects that were implemented in 1995 and the more recent Msunduzi project required the household to contribute to the construction of the household VIP in the form of digging the pit, levelling the ground, and supplying water for construction. The VIP project in Newlands, Eastern Cape required no contribution from the householder.

Table 53: Summary of community participation in VIP case studies

Case Study	Project Date	Settlement Type	User Education	Sweat Equity	Community Participation
Inadi, KZN	1995	Peri-urban	Yes	Yes	Local sanitation committee
Newline, Limpopo	1995	Rural	Yes	Yes	Local sanitation committee
Nkomazi, Mpumalanga	1995	Rural	Yes	Yes	Local sanitation committee
Mbazwana, KZN	1995	Rural	Yes	Yes	Yes
Thembalethu, Eastern Cape	1995	Rural	Yes	Yes	Community consultation with labour training
Newlands, Eastern Cape	2002	Peri-urban	None	None	Community committee assist with labour selection & social facilitation
Msundusi, Ward 7, KZN	2006	Rural	Yes	Yes	Community committee identified beneficiaries, local labour, local transport and local security used

An example of successful community participation in sanitation projects was at Inadi in Pietermaritzburg. After initiating the project the Institute of Natural Resources handed over to the local Siyathuthuka Sanitation Committee consisting of members of the community. Over the next 8 years any funds that were made available for sanitation in the area by the municipality were channelled through this community based sanitation committee, who worked in association with the Mvula Trust. The members of the committee were responsible for administering the finance and carrying out health and hygiene education.

Only four of the six UDS projects provided user education (Table 54). The eThekwini project provided user education to the households on five separate occasions.

Table 54: Summary of community participation in UD case studies

Case Study	Project Date	Settlement Type	User Education	Sweat Equity	Community Participation
Ducats, Eastern Cape	2001	Informal settlement	None	Yes	Demonstration units were constructed
eThekwini, KZN	2002	Peri-urban	Yes	None	User operation and management training, and health and hygiene education
Kammiesberg, Mpumalanga	2003	Rural	Yes	None	Awareness group helped in hygiene education
Koel Park, Western Cape	2004	Peri-urban informal	None	None	Some user awareness training
Bereaville, Western Cape	2004	Rural	Yes	None	Demonstration units to test acceptance, training
Ekurhuleni, Gauteng	2004	Urban	Yes	None	Employed in construction

The Ducats project was the only project requiring households to be involved in the construction of their toilet facilities.

In addition to health and hygiene education provided as part of community sanitation projects, user education in waterborne sewage projects is important to ensure the sewer system is not inadvertently abused.

Table 55: Summary of community participation in waterborne sanitation case studies

Case Study	Project Date	Settlement Type	User Education	Sweat Equity	Community Participation
Farm Dwellers, Western Cape	2000-2005	Rural	Yes	Yes	Farm community involved
Mountain View, Cape Town	1994	Informal urban	None	None	None
Ntuthukoville, Pietermaritzburg	1996	Urban	Yes	None	Local community trust, construction by community
Cuba Heights, Cape Town	2005	Informal Urban	None	None	None

6. EMPTYING OF PIT LATRINES AND UD LATRINES

On-going operation and maintenance is a key aspect of the sustainability of sanitation systems. This is particularly pertinent for VIP latrines as a large number have been constructed in both rural areas and in urban areas where other sanitation options were not economically feasible. This is the case both in South Africa and in other parts of Africa. Pearson (2002) states that the biggest remaining technical and financial problem with the Lesotho sanitation program is pit emptying. The only method in use (in Lesotho) is emptying by conventional suction tankers. This method requires the addition of water to liquidise the pit contents before suction, and is relatively expensive. It is impractical where the latrines are located far from tanker services, and if the latrines are also used for solid waste disposal then the use of suction tankers is particularly difficult (due to frequent blockages).

6.1 Observations of pit filling rates

A key factor in determining the operations cost of pit latrines is the rate at which the latrines can be expected to fill up. The rate of sludge accumulation in septic tanks and digestors is a topic better researched than the rate of filling of pit latrines. The WRC Report, *Sludge Build-Up in Septic Tanks, Biological Digesters and Pit Latrines in South Africa* (Norris, 2000) recommends that the filling rate of 29 litres/capita/annum is used as a design criteria for septic tanks, but quotes data from local and international experience which shows that filling rates vary from less than 10 litres per person per year to over 100 litres per person per year. Data quoted by Still (2002) shows an equally wide range of sludge accumulation rates in pit latrines, with 30 litres per person per year also being a reasonable guideline figure. Table 56 below shows results from four studies. In this table the one case where the filling rates were found to be significantly higher was Bester's Camp, near Durban, where the mean filling rate was found to be 69 litres/person/year. Indications are that this rapid filling is due to latrines in this area being poorly drained.

Although a median figure of 30 litres per person per year might be applicable, planners have to allow for the worst case scenario in determining how often to schedule routine pit emptying services. If the municipality is covering the emptying costs, then it is more far more cost effective to empty all the pit latrines in a village in a programmed sweep, than it is to do individual toilets on an ad-hoc basis. For this reason a more practical sludge accumulation figure for planning purposes will be 50 to 60 litres per person per year, resulting in pit emptying frequencies of 5 to 6 years, depending on pit capacity and on how much sludge is removed on each occasion.

Table 56: Observations of Pit Filling Rates (after Still, 2002)

Location	Reference	Age of Latrines	Number of Sites Monitored	Number of Visits	Avg. Pit Volume m^3	Range of Filling Rates Observed litres/capita/annum	Mean Filling Rate l/c/a
Soshanguve	WRC Report	approx. 3 years	11	14 over 28 months	1.96	13.1 to 34.0	24.1
Bester's Camp	City of Durban Report	four years	159	2 or 3 over 25 months	3.16	18.3 to 120.5	69.4
Mbila	Partners in Developm ent Report	approx. 5 years	11	1	2.83	10.0 to 33.2	18.5
Gabarone, Dar es Salaam	WHO Paper, 1982	not stated	not stated	Not stated	not stated	25 to 30	27.5 (implied)

To the above can be added the observations made in the case studies carried out at Inadi and Mbazwana in the course of this project, where the median filling rates were found to be 34 litres and 29 litres respectively.

Table 57: Further Observations of Pit Filling Rates (from case studies in this report)

Location	Reference	Age of Latrines	Number of Sites Monitored	Number of Visits	Avg. Pit Volume m^3	Range of Filling Rates Observed litres/capita/annum	Mean Filling Rate l/c/a
Mbazwana	Pg 43, this report	11 years	19	1	3.40	14 to 123	29 (median)
Inadi	Pg 38, this report	11 years	25	1	2.00	14 to 77	34 (median)

6.2 DWAF Guidelines for dealing with full latrines

In August 2005 the Department of Water Affairs and Forestry (DWAF) released a draft document on 'Guidelines for Pit Emptying as a Municipal Service' for the Basic Household Sanitation Programme. The options discussed in the document for emptying of pit latrines are summarised as follows:

- Abandon full toilet and build new toilet
- Seal full pit and relocate top structure over a new pit
- Empty pits more frequently to prevent a build up of waste (use vacuum tankers, use sludge pumps, use manual methods)
- Use composting or dehydrating latrines or use double pit VIPs

- Take steps to accelerate the breakdown of waste in pits (add water daily, mix pit contents every 6 months)

Larger pits are also recommended to ensure that pits do not reach their capacity too soon. If a method is selected that involves removal of the sludge from the pits then this has to be disposed of in a hygienically and environmentally safe way. Options for dealing with pit latrine sludge include:

- Bury sludge on site
- Compost sludge (use composting toilets, compost on site after removal, compost at temporary community site or municipal site)
- Treat sludge at existing sewage treatment works
- Incinerate sludge (at either municipal disposal facility or industrial facility)

6.3 Costs of emptying pit latrines and septic tanks

Still (2002) summarized different pit emptying methods and their associated costs and this is reproduced with updated costs in Table 58 below.

Table 58: Types of pit emptying and associated costs (adapted from Still, 2002)

Methodology	Source of Information	Cost (Range) for 2 m^3 in 2008 Rands
Manual excavation Old pit with fully decomposed contents	Standard Rates for Pit Excavation in Soil	R150 to R300
Manual scooping/flushing (Dar es Salaam) Handtools only	MAPET Report, SA Contractors	R100 to R220 (for 2m^3, but reported pit size is 10 m^3)
MAPET (Dar es Salaam) Cart mounted 200 litre vacuum tank indirectly coupled to handpump	Jaap Rijnsburger, WASTE	R160 (but not covering capital or support costs)
VACUTUG (Nairobi) Self propelled 500 litre tank with motorised pump	Graham Alabaster UNCHS, Nairobi	R360
MINIVAC Trailer Mounted, Tractor hauled 2000 litre tank	SA Contractors Lesotho	R400 to R1 200 low rate only applies for large scale scheduled work
VACUUM TANKER – URBAN 5 000 to 15 000 litres truck mounted tank	SA Contractors	R400 to R2 000 depending on efficiencies R800 default
VACUUM TANKER – RURAL 5 000 to 20 000 litres truck mounted tank	SA Contractors	R14 to R30 per kilometre return, e.g. 200 km return > R3 000

Table 58 shows that the costs are highly variable, depending on circumstances. The lower level costs are applicable for manual emptying, when the homeowner contracts the pit emptier directly. Large scale municipal programmes are far more complex, and require different levels of verification and control.

6.3.1 Summary of Pit Emptying Reports from the eThekwini Municipality

The eThekwini Municipality covers an area of approximately 2000 square kilometres extending 35 km north, 35 km south and up to 50 km inland from Durban Harbour. There are estimated to be in excess of 100 000 single vault pit latrines within the eThekwini Municipality's boundary, of which an estimated 45 000 are block structures with lined pit. An increasing number of these latrines are full. Pit latrine evacuations were previously carried out at the request of the householder on payment of an evacuation fee, but servicing latrines on an individual ad-hoc basis is prohibitively expensive. The municipality has therefore undertaken to evacuate every VIP latrine free of charge every 5 years, and estimates that there are some 45 000 latrines to be serviced.

Prior to a full-scale evacuation of latrines a pilot study was carried out by UWP Consulting (Pty) Ltd on behalf of eThekwini municipality. The three areas chosen for the study were:

- uMnini – a rural area
- Besters – a high density peri urban area
- Umlazi – an urban area with informal infill housing on steep terrain

The difficult terrain of the area is illustrated in Figure 47.

The terms of reference for the pilot study were as follows:

- To employ contractors to empty 500 pit latrines in each of the chosen pilot areas
- To investigate different methods of evacuating latrines and disposing of the sludge
- To evaluate methods employed
- To evaluate the success of the project
- To provide guidelines for full scale implementation of the project in terms of a schedule for pit emptying, a works programme, the cash flow requirements and the capital investment required
- To consider means of black empowerment

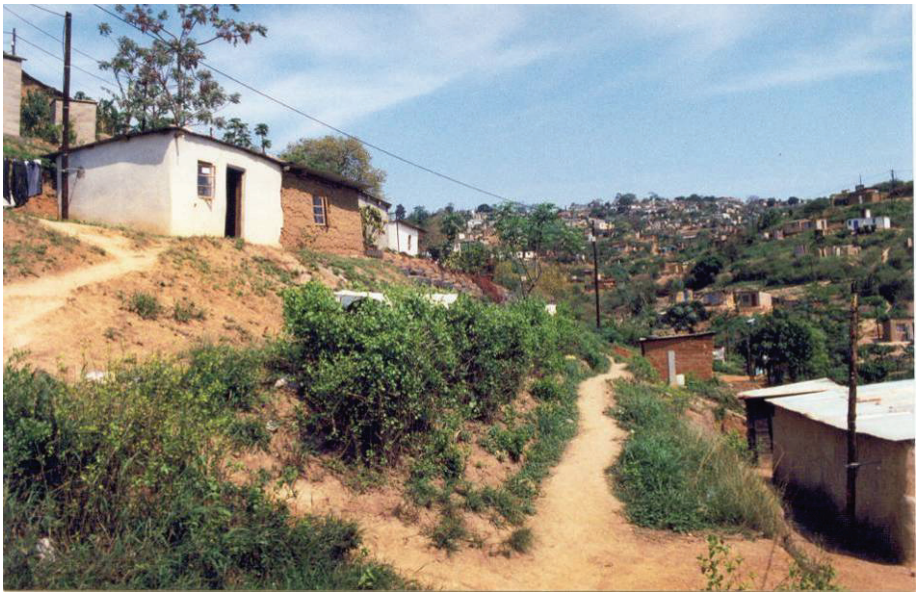

Figure 47: The Besters Camp area is typical of the steep terrain and difficult access to households in some areas of eThekwini Municipality (UWP, 2004)

The following methods were evaluated:

- Suction tanker
- Hand pumps
- Manual evacuation

For the suction tanker and hand cart methods a water cart was required to dilute the sludge before it could be sucked out. This increased the volume of sludge to be evacuated by up to twice as much.

The suction tanker option consisted of a pressure tank and suction hose. The advantages are that it can be quick, efficient, and relatively clean and there is no double handling of waste. The disadvantages are that the vehicle is expensive; it is difficult to manoeuvre through narrow streets; to fill the tank the vehicle needs to be parked on level ground; and any debris larger than 100mm blocks the suction pipe.

In areas where the pits were inaccessible to the suction tanker, hand pumps were used, in conjunction with a trailer-mounted storage tank, towed by a tractor. A number of pumps were experimented with including submersible grinder pumps. The diaphragm pump was found to be most suitable. The diaphragm pump had a suction head of almost 10 metres and a pumping head of up to 30 metres. However, it was found that the pump would block

continually with debris, which meant the system frequently had to be dismantled and cleaned.

For manual evacuation long handled spades and forks were used (Figure 48, left). The sludge was tipped into 100 litre drums, which when full, were put into customised trolleys and taken to the nearest road (Figure 48, right), where a 3 ton truck would take away full drums and drop off empty ones.

At the processing yard were two skips. The dry sludge was tipped into the first one, where water was added and the non-organic debris was removed and placed into plastic bags and put into the second skip. The diluted sludge was then cleared of debris, sucked up by the suction tanker and taken to the wastewater treatment works. The advantages of the manual evacuation method are that any pit is accessible, there is low capital outlay, and it is the most cost effective of the methods investigated. The disadvantages are that it is a three stage operation and the skips are parked near houses.

Figure 48: A labourer softening the sludge and removing the debris from the latrine, left; full tanks of sludge proved difficult to move up steep slopes, right (UWP, 2004)

The costs for evacuating the pits in the pilot study are shown in Table 59. For uMnini and Besters a combination of the suction pumps, hand pumps and manual evacuation were used to empty the pits as in some areas it was not possible to use the tank or the hand pump.

In Umlazi only manual evacuation was used due to the steep terrain which prevented access by the tankers and pumps. It was found that the manual evacuation was the most cost

effective method and was able to maximise labour. For these reasons eThekwini municipality decided to proceed with a full-scale manual evacuation programme.

Table 59: Cost of pit evacuation from UWP case study (2004 Rands)

Area & description of evacuation	Daily costs per pit				
	Evacuation	Processing	Removal	Profit	Total (inc VAT)
uMnini: using tanker, hand pumps and manual evacuation	737.85	329.92	934.55	n/a	1702.32
Umlazi: using manual evacuation only	457.55	254.28	72.96	n/a	1184.79
Besters: using tanker, hand pumps and manual evacuation	437.85	329.92	934.55	n/a	1702.32
Full scale evacuation: manual evacuation and customised screens	312.74	182.78	52.14	81.15	629.8*

* Estimated costs for full-scale evacuation programme using manual method only

In 2007 eThekwini contracted a project manager and a contractor to empty 50 000 pit latrines over a five year period. The expected costs were at the time R1 100 per latrine[6], but by March 2009 the mean cost per pit emptied was estimated at R1 800[7]. The programme ran into unexpected difficulties when the operators of the waste water treatment plants found that their plants could not deal with the extra sludge load generated by the pit emptying programme, and so on-site burial and off site landfill was adopted for the sludge disposal.

Meanwhile the deep bed entrenchment of pit sludge in conjunction with tree plantations is being investigated by eThekwini in conjunction with the Water Research Commission. This system has been researched and monitored with very positive results by the University of Maryland, United States, since 1983, disposing of secondary wastewater treatment sludge.

6.3.2 Northern Cape experience with pit evacuation

In 2005 H. Fouche consultants compiled a pit emptying report from their experience with selected municipalities in the Northern Cape. The pilot study looked at the emptying of the pits of both VIPs and Urine Diversion toilets. It was found that many of the UD pits were wet and a tanker was required to empty them. The UD pits were below ground level (unlike the

[6] These figures were presented by Peter Davis, head of operations for the waste water division of eThekwini Water Services, at the National Dry Sanitation Working Group meeting held in Pretoria in April 2007.

[7] This was the estimate given at the monthly Pit Emptying Programme steering Committee meeting held at eThekwini Water Services on 11 March 2009.

eThekwini design) and were not lined and often had rainwater and groundwater entering them. Also at certain study sites high percentages of the urine pipes where blocked or damaged. The report concluded that at many of the households that had UDs there was a low level of maintenance and lack of general awareness of how to look after the toilet. The pilot study looked at the removal of waste from dry UD pits by hand and from wet UD pits using a suction tanker. A suction tanker was used for the evacuation of waste from VIPs.

Table 60: Pit emptying costs (2005 Rands) from pilot evacuation studies in the Northern Cape

	Campbell	Sutherland	Fraserburg	Concordia	Van Wyksvlei	Marydale
System	UD	UD	UD	UD	VIP	VIP
No. pits emptied	187	263	80	728	218	57
Broken urine pipe (%)	21	0	-	0.1	n/a	n/a
No. people employed	6	5	1	10	7	2
Predominant method of emptying used	By hand	Diaphragm pump	Suction tanker	By hand	VACUTUG	Suction tanker
Pit emptying cost (R)	217	120	35	34	193	60

In the report the cost of emptying with each method, i.e. suction tanker or by hand, is not stated only the average cost and what percentage of the pits were evacuated by hand and suction pump. Therefore, in Table 60 only the predominant method of evacuation is given for each site.

It is notable that the pit emptying costs in these Northern Cape examples is particularly low. It is probable that only direct costs (labour, fuel) etc have been included, with management costs excluded. Also the very low costs for two of the UD sites (Fraserburg and Concordia) will relate to small pit volumes.

6.3.3 Discussion of pit emptying options and costs

It is difficult to generalise about pit emptying costs, due to the wide variety of physical conditions and contractual conditions that apply. The following conclusions are possible, however.

i) Although it is not a pleasant or easy job, and there are significant health risks, it is far cheaper to empty pits by hand than to use vacuum tankers.

ii) In many cases it is impossible to empty pits using vacuum tankers due to problems with access and the presence of solid waste in the pits.

iii) The cheapest, simplest and most practical pit sludge disposal option is to bury it on site near the pit latrine from which it has been removed. In rural areas, there is no practical or affordable alternative.

iv) Municipally driven pit emptying programmes will result in costs that are substantially more expensive than the basic labour cost of the operation, due to the complexities of management, control and sludge disposal.

v) In 2008 Rands a budget figure of R30 per toilet per month is sufficient to cover any pit latrine or septic tank emptying option.

vi) It is substantially easier and cheaper to empty UD toilets, although the task has to be done more frequently.

6.4 Comparison with the cost of operating waterborne sanitation

Fully waterborne sanitation remains the most attractive sanitation option for most people (and most politicians) and if finance and the availability of water were not constraints, it would invariably be opted for. How does the cost of operating a waterborne sanitation system compare with the cost of emptying pit latrines and septic tanks?

If one assumes that average household occupancy is five people, that each member uses the toilet on average four times per day, that six litres is used to flush the toilet and that the toilet never leaks, the monthly average household water consumption just for toilet flushing would be 3.6 kilolitres. In reality once a home has internal plumbing the monthly water consumption tends to be in the region of at least 100 litres per person per day, or 15 kilolitres per month for a family of five. Where there is poor maintenance of plumbing fittings, and where payment is neither required nor enforced, typical household monthly water consumption escalates sharply.

This water has to be supplied as potable water, and then the sewage has to be collected, treated and returned to the environment.

If it costs a municipality R6 per kilolitre to supply the potable water, and R4 per kilolitre to collect and treat the sewage[8], then the total cost to the municipality per kilolitre used is R10 per kilolitre. Table 61 below gives an indication of the cost to a municipality for operating and maintaining a waterborne sanitation system, using a range of costs and consumptions.

Table 61: Indicative Cost to a Municipality for Operating and Maintaining Waterborne Sanitation

Average monthly household water use apart from basic human needs (estimated at 25 litres per person per day)	Cost per kilolitre to supply clean water and to collect and treat sewage (Rands)		
	7.50	**10.00**	**12.50**
5	37.50	50.00	62.50
10	75.00	100.00	125.00
15	112.50	150.00	187.50

Table 61 shows that even under the lowest cost scenario (R7.50 per kilolitre of potable supplied and then collected and treated as sewage, and only 5 kilolitres used per family per month above the 25 litres per person per day basic human need) the cost to a municipality to operate and maintain a waterborne sanitation system is going to be in the order of R37.50 per family per month. This lowest cost scenario is more than the highest costs observed in assessing the costs of servicing pit latrines (refer to Section 6.3 above).

A more realistic cost scenario (R10 per kilolitre supplied as potable water then treated as sewage and an extra 10 kilolitres used) results in a monthly cost nearly three times higher at R100 per family per month. If there is no control of water usage and it gets to above 30 kilolitres per family per month without being paid for, then the cost to the municipality will be three times as much again.

These costs do not include the costs of constructing, upgrading and refurbishing sewage treatment plants, which have to meet stringent effluent discharge quality requirements (these

[8] In 2006 Durban did a global assessment of the cost of operating its wastewater systems and derived a figure of R3.30 per kl. Bill Pfaff, Strategic Planning manager for eThekwini Water and Waste at the time, described the assessment as follows:

If eThekwini were to introduce a User Charge (to replace sewerage rates) the rate would be in the order of R3.30 per kl (excl VAT). This is determined by taking the costs of the Dept, less income (from trade effluent charges etc), divided by the estimated volume of sewage discharged from properties into the sewerage reticulation. This is a good indication of the operating cost of running a municipal sewerage system and, in our case, includes the efficiencies of a number of large sewerage works and the two sea outfalls.

costs vary widely depending on technology and conditions, from less than R2 million to more than R15 million per Megalitre per day – see Appendix D for a discussion). They also do not include the cost to public health and the environment when sewers and sewage treatment plants are allowed to spill untreated or only partially treated sewage, which happens all too frequently in South Africa.

Wolmaransstad: A cautionary tale

As part of South Africa's drive to rid the country of bucket toilets, which are not considered acceptable, several hundred thousand of these toilets have been upgraded to VIPs or flush sanitation in the last few years. In the town of Wolmaransstad some 3500 bucket toilets were upgraded to full flush sanitation, although nearly half of the beneficiaries are indigent and unable to pay for the water. The result was a major increase in the town's water demand, and a collapse in the water supply. The Development Bank of South Africa had to be called in to assist with the construction of a new R120 million supply augmentation pipeline from Bothaville. The additional expenditure indirectly incurred by the upgrade from buckets to fully waterborne sanitation was therefore over R30 000 per household. (Marler, 2009)

7. FINANCING BASIC SANITATION IN SOUTH AFRICA

Like access to water, access to sanitation is considered to be a right in South Africa. In terms of a government policy which came into force in 2001, the provision of basic sanitation for all is a municipal responsibility and should be provided free to the poor (defined at the time as those families with a monthly income of less than R800, but in practice all families resident in communities considered to be poor).

7.1 The Free Basic Sanitation policy

In 2001 the South African government introduced the policy of free basic services to the poor. In the case of water supply the *guideline* given to local government was that each family should receive 6 000 litres of free water per month, although substantial freedom was given to allow each Water Services Authority to decide exactly how to implement the policy. The formulation of guidelines for free basic sanitation has proved more complicated. The Strategic Framework for Water Services of 2003 provides the following guidance:

Definition of basic sanitation (SFWS, 2003)

The provision of a basic sanitation facility which is easily accessible to a household, the sustainable operation of the facility, including the safe removal of human waste and wastewater from the premises where this is appropriate and necessary, and the communication of good sanitation, hygiene and related practices.

Regarding choice of technology and maintenance of the technology, the SFWS has the following:

Choice of technology. *The definition of a basic sanitation service does not define the technology to be used in providing such a service. This decision, made by the Water Services Authority, is the key to success in providing free basic sanitation services in a sustainable manner. The selection of technology is strongly dependent on settlement conditions. Water Services Authorities must typically address the following situations:*

- *In urban areas, where many businesses are located and where residential densities are high, waterborne sanitation is generally the most appropriate technical solution and should be regarded as a basic level of service for the purposes of the free basic sanitation policy.*
- *In rural areas, where housing densities are low and few businesses are located, on-site technical solutions are an appropriate basic level of service.*

- *In intermediate areas (for example, peri-urban areas or rural areas where settlement densities are high), a water services authority must decide on an appropriate technology which is financially viable and sustainable. In most instances, on-site sanitation systems are likely to be the most appropriate solution. Care must be exercised when choosing waterborne sanitation systems in this context. The water services authority must ensure that the water services provider will be able to maintain and operate this system sustainably over time with the available funds.*

The Strategic Framework for Water Services goes on to Introduces the possibility of consumers managing their own sanitation facilities in rural areas, and includes planning for maintenance and operation as a responsibility of the WSA:

***Operating the service**. The arrangements for operating the sanitation service must be properly understood before the financial arrangements for subsidising the operating costs of free basic sanitation can be addressed. In many rural areas it is unlikely in the foreseeable future that water services providers operating in these areas will have the capacity to empty or relocate Ventilated Improved Pit toilets (VIPs) and hence it will often be necessary for households to manage the sanitation facilities themselves. The subsidy arrangements need to take these factors into account.*

Furthermore the Strategic Framework for Water Services states that if the basic service is to be provided free to the poor then the Water Services Authority must ensure that the costs of providing the service are covered by the local government equitable share and/or through cross-subsidies within the Water Services Authority area. These funds must be paid to the Water Services Provider who operates the service or directly to the households. All Water Services Authorities are required to develop a policy to define how this will be addressed.

7.2 Review of Local Government Finance for Basic Services provision

The funding mechanisms by which these basic services are supplied are clear: Municipal Infrastructure Grants (MIG) for infrastructure development, and tariff cross-subsidisation and the Local Government Equitable Share for operation and maintenance.

Section 4 of the Municipal Systems Act (Act 32 of 2000) states that: “The council of a municipality has the right to finance the affairs of the municipality by (i) charging fees for services; and (ii) imposing surcharges on fees, rates on property and, to the extent authorised by national legislation, other taxes, levies and duties”. This suggests that municipalities should fund basic services from revenue. This would put the burden on

ratepayers, and in most cases municipalities would find themselves with inadequate means to meet national targets. National government has recognised that additional funds are required so that municipalities can provide free basic services to poor households (National Treasury, 2007).

Two grants are provided by National Government to assist municipalities with the cost of basic services provision: the Municipal Infrastructure Grant (the MIG) and the Equitable Share. Section 7.2.1 and 7.2.2 below describes how these grants apply to basic sanitation.

7.2.1 The Municipal Infrastructure Grant

The Municipal Infrastructure Grant, or MIG, is provided to all municipalities to assist them with the costs of providing roads, water, sanitation, electricity and refuse removal to communities who are wholly or partially unserved with these amenities. Each year the Division of Revenue Act sets out the allocation of the MIG, which is calculated according to the following formula:

MIG = C + B + P + E + N + M

C **Constant to ensure increased minimum allocation for poor municipalities (This allocation is made to all municipalities)**

B Basic residential infrastructure (new and rehabilitation of existing ones). Proportional allocations for water supply and sanitation, electricity, roads and 'other' (Street lighting and solid waste removal)

P Public municipal service infrastructure (new and rehabilitation of existing ones)

E Allocation for social institutions' and micro-enterprises' infrastructure

N Allocation to all nodal municipalities

M Negative or positive allocation related to past performance of each municipality relative to grant conditions

The MIG grant was introduced for the first time in the 2005/2006 financial year, consolidating a number of pre-existing grants into one new grant. In that year the total grants made under the new grant amounted to R5.4 billion. In the current (2008/2009) financial year the total MIG grant is expected to amount to R8.6 billion, and by 2011/2012 the grant is expected to total R15.1 billion.

In order to access the MIG grant a municipality must submit a business plan. For sanitation projects a Sanitation Project Implementation Plan (or SPIP) must be submitted and approved by the Department of Water Affairs and Forestry (DWAF). DWAF uses cost guidelines to determine appropriate funding levels for different types of infrastructure, and for sanitation is currently working with the document *Guidelines for the Costing of Household Sanitation Projects* (DWAF, 2007).

This guideline concludes with the following table of typical maximum and ceiling costs for a range of sanitation options, showing how these should escalate year on year at 8% but stating that the actual escalation percentage should be determined according to the STATSSA indices for the construction industry:

Table 62: DWAF Guideline Cost Table for Basic Household Sanitation (DWAF, 2007)

Sanitation Type	Ceiling cost	Typical maximum cost	Ceiling cost	Typical maximum cost	Ceiling cost	Typical maximum cost
	2007-2008		2008-2009		2009-2010	
VIP – fixed top structure or double pit	R 4,550	R4,050	R 4,914	R 4,375	R 5,307	R 4,725
VIP – movable top structure	R 4,550	R4,250	R 4,914	R 4,590	R 5,307	R 4,957
Composting and Desiccating latrines	R 5,550	R4,550	R 5,994	R 4,914	R 6,474	R 5,307
Wet on-site digesters (Aquaprivies)	R 5,600	R4,500	R 6,048	R 4,860	R 6,532	R 5,249
Flush Latrines with Septic Tanks & Adsorption Trench	R7,500	R6,300	R 8,100	R 6,804	R 8,748	R 7,348
Flush Latrines with Septic Tanks & solids free sewer + Pond Treatment	R12,600	R9,000	R 13,608	R 9,720	R 14,697	R 10,498
Flush Latrines with Waterborne Sewers and Biological Treatment	R14,500	R10,550	R 15,660	R 11,394	R 16,913	R 12,306
Flush Latrines with Waterborne Sewers to conservancy tank and Biological Treatment	R13,500	R9,300	R 14,580	R 10,044	R 15,746	R 10,848

Note: The above table is based on 2007 base prices, with a nominal escalation of 8% applied to derive the 2008 and 2009 prices. The actual construction sector cost escalation from July 2007 to June 2008 was approximately 16% according to the StatsSA/SAFCEC escalation indices.

Appendix A includes drawings and costed Bills of Quantities for three basic latrine types: a single pit VIP; a double pit VIP and a single pit Urine Diversion toilet.

7.2.2 The Local Government Equitable Share

The Division of Revenue Act, which is tabled annually, sets out the way in which national revenue will be divided between National, Provincial and Local Government. Transfers are paid to municipalities through the Department of Provincial and Local Government. Apart from a variety of infrastructure grants, the main operating grant is the Local Government Equitable Share (LGES). It is an unconditional grant in terms of section 214(1) (a) of the Constitution (Act 108 of 1996), and this allows municipalities to spend it at their own discretion.

The basic formula used to calculate the LGES is:

Grant = BBAF (BS + D + I) – R ± C

where:

BBAF is the Budget Balancing Adjustment Factor
BS is the Basic Services Component
D is the Development Component
I is the Institutional Support Component
R is the revenue raising capacity correction
C is a correction and stabilisation factor.

The Basic Services Component (BS)

- Is provided to enable municipalities to provide free basic services to poor households.
- Recognises water reticulation, sanitation, refuse removal and electricity reticulation as the core services for which poor households must be subsidised
- Defines poor households as those earning less than R800 per month
- Provides a sum for environmental health care for all households
- Is allocated to municipalities according to the services for which they are responsible.
- Distinguishes between those households that actually receive services from the municipality, and unserviced households
- Calculated using the formula:

BS= [Water Subsidy 1 x no. of poor households without adequate water services + Water Subsidy 2 x no. of poor households without adequate water services] + [Sanitation Subsidy 1 x no. of poor households with adequate sanitation + Sanitation Subsidy 2 x no. of poor households without adequate Sanitation] +

[Refuse Subsidy 1 x no. of poor households with refuse removal +
Refuse Subsidy 2 x no. of poor households without refuse removal] +
[Electricity Subsidy 1 x no. of poor households with electricity supply +
Electricity Subsidy 2 x no. of poor households without electricity supply] +
[Environmental Healthcare Subsidy x Total number of households]

- The guideline subsidies (per poor family per month, before adjustment (see Table 63) are:

Service costs per month (R)	Serviced Households (Subsidy 1)	Unserviced Households (Subsidy 2)
Electricity	45	16
Water	30	10
Refuse	30	10
Sanitation	30	10
Total	135	46

Source: Part 4, Division of Revenue Bill, 2009

- The subsidy for environmental health care services is R12 per household.
- Households using VIPs are classified as "unserviced" for this calculation.

NB: While these figures were revised after a study by the DPLG in 2004, they still only define the proportions of the basic services allocated to different services, since the actual amounts are adjusted when the budget balanced grant is calculated – the average municipality receives more than double the above allowances as shown in Table 63 below which appears in the Division of Revenue bill tabled in February 2009.

Table 63: Average Equitable Share subsidies allocated to municipalities as per the Division of Revenue Bill 2009

Monthly	Serviced households			Households not connected to services		
Rand	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Electricity	136.9	172.0	188.4	50.6	63.3	69.2
Water	97.0	122.1	133.8	28.9	36.0	39.4
Sanitation	64.0	80.9	88.7	42.7	53.3	58.2
Refuse	60.3	76.3	83.7	44.5	55.6	60.7
Total	**358.1**	**451.2**	**494.5**	**166.7**	**208.1**	**227.6**

The Development Component (D)

- Set at zero until government has decided on a measure for the developmental needs of municipalities.

The Institutional Support Component (I)

- To support administration and governance
- Calculated as:

I = Base allocation + [Admin support x Population] + [Council support x Number of Seats]

I = R350 000 + [R1 x population] + [R36 000 x no. of councillors] in 2007.

The revenue raising capacity correction factor (R)

- Used to reduce the equitable share for municipalities according to their demonstrated revenue-raising capacity and approximations obtained from Stats SA.
- Calculated at 5% of the revenue that should be available to a municipality.

The Stabilising Constraint (C)

- An adjustment which ensures that municipalities receive a guaranteed proportion of the amount allocated to them in the Medium-Term Expenditure Framework (MTEF), which is the rolling three year budget cycle.

The Budget Balancing Adjustment Factor (BBAF)

- Applied so that all LGES grants are fit within the amount budgeted by the National Treasury (NT).

Appendix B includes tables extracted from Hazelton's 2008 report *The new Local Government Equitable Share Formula and its Impact on Water Services* showing how much funding is currently allocated for each of South Africa's 169 Water Services Authorities. The tables also show how much funding is received for each basic service (water, sanitation,

electricity, refuse removal) and how much is received per poor household, and indicate trends in this funding year on year.

7.3 Sustainability of finance

South Africa is firmly committed to the provision of free water and sanitation services to all its people. This commitment is underwritten by transfers from the national treasury to local government to cover the costs of both construction and maintenance. These transfers appear to be affordable in the context of the national budget (R800 billion in 2009), are being escalated at rates at or above inflation year on year and there seems to be no prospect that they will be reduced in real terms in the foreseeable future.

7.4 DWAF's Free Basic Sanitation Implementation Strategy

On 21 March 2009 the Minister of the Department of Water Affairs and Forestry approved the *Free Basic Sanitation Implementation Strategy (DWAF, 2009).* This document is intended to give Water Services Authorities a framework for planning and operating sanitation services for the poor. It provides substantial leeway to municipalities to determine how to go about this, depending on their geography, demographics, income distribution and capacity. Under Section 6.4 of this document, titled *What are the limitations to providing the service free, in relation to capital and operating expenditure?* the following guidance is given:

As noted in Section 6.1 it was implied that 'free' sanitation means that the poor household does not have to contribute towards the cost of providing the service initially (capital) and managing the service in the long term (operating). However, there are certain limitations in this regard:

Construction of new infrastructure and rehabilitation of infrastructure (Capital items):

- *Poor households will not be required to fund the capital cost of constructing the infrastructure necessary for a basic service but with the proviso that the water services authority may set a ceiling amount of capital to be allocated for construction per household.*
- *Where rehabilitation of infrastructure is required (a capital item) this will be provided free. But this excludes the 'on site' infrastructure which is the responsibility of the household with an exception described below.*
- *An exception may be made by the water services authority for the rehabilitation costs of pits or tanks, the underground infrastructure associated with 'on site' sanitation. Typically such an exception may apply to situations where it is not feasible to empty ventilated pit latrines and relocation of such pits is required. It may also apply to rehabilitation of collapsed pits.*
- *The rehabilitation of buildings, pedestals and pipework, which are part of the 'on site' facility, is the household's responsibility.*

Operating and maintenance of infrastructure

- *Households are responsible for the day-to-day operating costs of the 'on-site' component of the service. This includes providing anal cleansing material, cleaning the pedestal and the room or privy in which the toilet is located, and ensuring that solid waste is not discharged into pits or tanks.*
- *In the case of systems which require flushing, the household must ensure that the 'on site' water pipe work and flushing systems are fully functional and that water used beyond the limit set for free basic water is paid for.*
- *Day-to-day maintenance of the complete 'on site' facility is the responsibility of the household. This includes all repairs to pits, tanks, pipes, pedestals, flushing mechanisms and buildings in which the toilet is housed. However, an exception may be made with regard to sludge or compost handling, as described below.*
- *As far as possible 'on site' sanitation systems should be designed so that the household can themselves manage the sludge or compost which is produced. However, where this is not possible the water services authority may arrange for a sludge or compost removal service to be provided to the household free.*

Source: DWAF Free Basic Sanitation Implementation Strategy, 2009

8. PLANNING BASIC SANITATION PROJECTS

The case studies in Section 4 of this report indicate that a wide variety of sanitation options are being implemented in South Africa, with varying degrees of success. There is no one solution for all situations, and in some cases more than one possible solution may be appropriate.

The responsibility for the choice of sanitation for a given area rests with the Water Services Authority. Over the years several decision tools have been developed to assist planners with sorting through the large number of factors which affect sanitation choice. Among these are the following:

- *The Site Sanitation Planning and Reporting Aid (SSPRA)* developed by Howard et al. (2000)
- Drangert's *Ecological Sanitation Selection Algorithm*
- The NORAD/DWAF *Decision Making Framework for Municipalities* (by Holden et al., 2005)
- *The DWAF Groundwater Protocol* (1997)

These are discussed in more detail in Appendix C. Figure 49 shows the sanitation selection decision tree which forms part of the *Decision Making Framework for Municipalities* developed by Holden et al. for Norad and DWAF in 2005.

This tree shows that before waterborne sanitation can be considered, the following questions require the answer "Yes":

- Is there a household water connection?
- Is there sufficient water in the resource?
- Is there sufficient capacity in the works (water treatment and waste water treatment)?
- Is the waste water treatment works working properly?
- Does the sewer network have sufficient capacity and is it working properly?

If the answer to any of the above questions is negative, then waterborne sanitation can only be considered if the funds and the plans are in place to make the necessary changes that will change the answer to positive.

For sanitation to work it must be technically, socially and financially feasible. Failure in any one of these areas will cause the service to fail. The logical planning approach is to narrow the options down to those which are technically and socially feasible, and from there to proceed to an assessment of the financial feasibility.

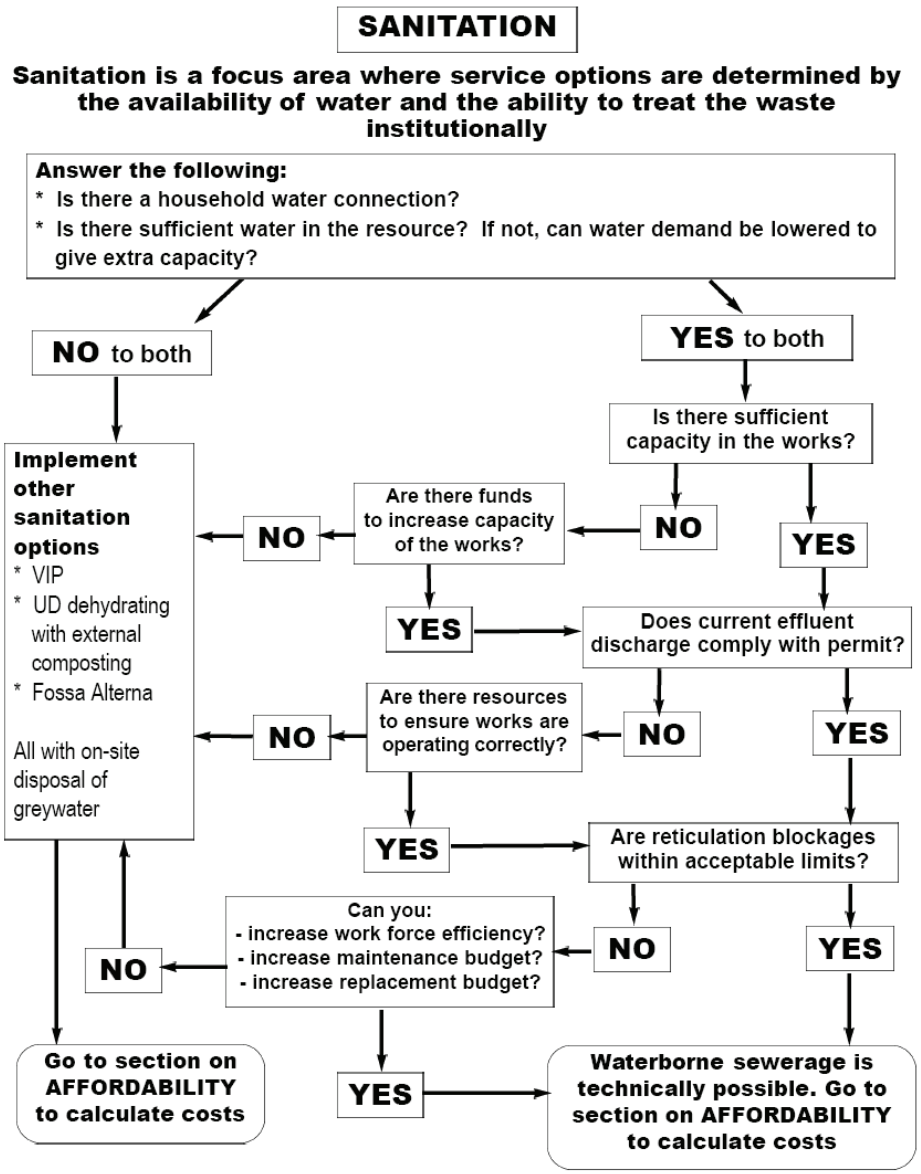

Figure 49: The Norad/DWAF Decision tree for Sanitation Selection (Holden et al., 2005)

8.1 Technical and Social Feasibility Considerations

The obvious question to ask of members of a community when planning a new sanitation project is "what type of sanitation system do you want?" The problem with asking this question too early in the process is that it may well give the impression that all the options

are on the table, which due to other technical or financial considerations may not be the case. The following are appropriate social and technical questions to ask at the planning stage.

Social considerations:

Does it matter whether the toilets are located inside or outside the house? In rural areas with large plots, it may not matter too much that the toilet is located 10 or 15 metres from the house. However, in a densely populated urban area where crime is a problem, it will make a big difference to people to have their toilets built into their houses. If there is a definite need to locate the toilets inside the dwellings, then VIP latrines are excluded.

What type of anal cleansing material is likely to be used? If a community is very poor they are unlikely to be able to afford to buy toilet paper, and using water for anal cleansing (the standard practice in Asia) is not generally practiced in South Africa. Waterborne sanitation is not advised if bulky anal cleansing materials such as newsprint are to be used.

If the locally applicable free water allowance is not sufficient to cover waterborne sanitation, will the community pay for the extra water they consume? If the answer is no, and if the municipality does not have the resources to cover the additional cost internally, then waterborne sanitation is not advised.

Technical considerations:

Is there an adequate and reliable on-site water supply or will there be when it is needed? The increased demand required for waterborne sanitation is up to 10 kl per family (above basic needs) per day. If this question cannot be answered in the affirmative, then any sanitation system requiring a reliable flush of more than one litre per use should not be considered.

What is the mean plot size? Where plot sizes are very small (100 to 150 m^2) VIP toilets are not ideal and other options such as waterborne or UD should be considered. Very small sites are also not good for options requiring on site drainage, such as septic tanks and pour flush latrines.

Is the soil depth less than 1 metre? If soil depth is very shallow (a metre or less) then single pit VIP latrines are not suitable. Double pit VIPs or UD toilets can be used, or

waterborne sanitation. Septic tanks may still be possible, depending on the soil percolation (see below).

Is the slope of the site steeper than 25%? Options requiring on site drainage are not suitable for very steep sites.

What is the soil type? Very clayey soils with low permeability are not suitable for septic tanks. However, very coarse gravely soils are also not ideal for septic tanks if there is a source of drinking water within range (up to 75 metres, if the soil is very coarse and the groundwater flow is strong).

Is the area prone to flooding? If it is prone to flooding, even if the groundwater table regularly rises to ground level, then septic tanks and pit latrines are not suitable.

Is there sufficient capacity in the sewer network and the sewage treatment plant to deal with the additional load on the system? If waterborne sanitation seems the likely option, then the capacity of the sewers and the sewage treatment system to handle the extra load must be checked.

As an adjunct to this project an interactive programme has been developed to take a decision maker through the above set of social and technical questions, which a result sheet which indicates by a tick or a cross which sanitation options are at least possible, whether or not they are affordable. The programme is called “Which San?” (see Section 8.3 below) and the programme output for two typical sanitation scenarios (one rural, and one urban) can be found in Appendix C.

8.2 Financial Feasibility Considerations

To assess financial feasibility both the capital and the operating costs must be checked against the available funding. This means that the planner must start with a good idea of how much funding is available. This may simply be the MIG capital grant, but in some cases the municipality might have allocated additional funding from elsewhere. For operations and maintenance the Equitable Share funding is given to municipalities to assist them with the provision of services to the poor, but experience indicates that this funding does not all get applied to the purpose for which it was intended in terms of the Division of Revenue Act (which is nevertheless legal as the grant is unconditional, in terms of the Constitution).

The following questions will help a planner to make the right sanitation choice as far as capital and operations cost estimates are concerned:

Capital Costs:

How much money is each household contributing to the construction, either in cash or the relative value of sweat equity? Each household may either be contributing cash to the construction of their sanitation facilities, or may be contributing sweat equity, for example by digging their own pit.

How much money is coming from other sources? Additional money for construction could be coming from a variety of other sources e.g. international aid, national government, local government, or a non-governmental organisation.

Approximately how many people live at each site? This enables costs per person to be calculated.

The cost of a VIP, UD or septic tank toilet will depend on the design, the cost of materials, the cost of labour, and the contractual arrangements (i.e. how many levels of supervision, control and management are involved – the more levels, the more expensive the job).

The following questions would only be asked if fully waterborne sewerage is found to be feasible following the technical feasibility questions.

How far is the main sewerage network? The cost to connect the project site to the sewerage network must be included in the project construction cost calculations

What is the current maximum capacity of the sewage treatment works, and what is the current use of the sewage treatment works? If the capacity of the sewage treatment works needs to be increased to cope with the additional demand created by the project, then the cost of increasing the capacity needs to be taken into account when calculating project construction costs.

What type of sewerage treatment plant would be used? Different sewerage treatment technologies have different construction costs. Oxidation ponds, polishing wetlands and related technologies (e.g. high rate algal ponds) are significantly cheaper than the more sophisticated activated sludge plants, but require more land.

What sewer pipe diameter will be required for the bulk main in the project area, and what will be required for the internal reticulation? In most townships the greatest part of the internal sewer reticulation is made up using 150 mm pipe – often a smaller size would suffice if purely hydraulic considerations were applied, but municipal engineers prefer the larger size for maintenance purposes. For the bulk collectors larger pipe sizes may be required depending on the population served.

What is the expected excavation cost? To enable the total cost of laying sewerage pipes to be calculated, the cost of the excavations also needs to be included. The basic cost is a direct function of total excavation volume (i.e. length times width times depth). However, excavation unit costs vary considerably depending on the method used[9]), the depth[10] and the difficulty in removing the soil depending on whether it is soft, intermediate or hard.

What is the estimated total cost of the manholes? Manholes are one of the greatest contributors to sewer costs. They are required at every junction, every change of gradient and every change of direction. Deep manholes require steps for access. The base of the manhole must be formed ("benched") to ensure that the converging sewage flows smoothly and is not snagged. All of the above make manholes expensive items, typically costing in the order of R4 000 or more. However, the shallower the sewers, the less the cost of the manholes, and therefore sewers must start at a shallow depth (e.g. 500 mm below the surface). From the depth at the starting point the depths further down the system are governed by topography and minimum grade considerations (1:200 is usually the flattest grade allowed, to minimize blockages).

Operation and Maintenance

In order to estimate the monthly cost of operating and maintaining a sanitation system per household, the following questions must be answered:

Who would be responsible for maintenance?

Either the householders, the municipality, another organisation or a combination could be responsible for maintenance of the sanitation facilities. The answer may depend on the type

[9] Although manual labour is desirable for employment creation, it is only competitive with plant in shallow trenches in soft soils. For highly cohesive (clayey) soils or for harder materials (e.g. weathered shale) plant is usually half the price or less for the same task. Also, labour productivity declines steeply as trench depth increases.

[10] Contractors' costs for excavation increase sharply with trench depth. Also, any trench deeper than 1.5 metres has to be shored to protect worker safety. Due to the requirement to achieve minimum falls sewer trenches can be very deep, especially if the surface topography is flat.

of sanitation service envisaged. For example, if Urine Diversion toilets are planned, it may be reasonable to expect the owners to carry out and pay for the maintenance themselves. If waterborne sanitation is planned, there may be cost recovery from some of the users, but no cost recovery from indigent areas, and the actual maintenance work (except for on-site plumbing care) is likely to be entirely in the hands of the municipality.

How much money is available for maintenance?

How much is the municipality or are the users able and prepared to provide for the maintenance of the sanitation facilities? In order to answer the question willingness to pay studies may have to done. Coupled with this there may be a requirement to assess whether the envisaged operation and maintenance tariffs to be levied on users are considered affordable relative to the typical local household's disposal monthly income.

Waterborne sanitation questions:

The following question would only be of relevance if fully waterborne sewerage is being seriously considered as an option:

How much additional water will households use if they are connected to waterborne sanitation, what are the cost implications of this additional usage and who will pay for this water? Each municipality has set its own limit for free basic water provision. Any usage above this level should theoretically be paid for by the users, but if families are indigent they may refuse to pay anyway. Each kilolitre of water costs the municipality a certain amount in terms of bulk water costs and reticulation costs, which may be less than the tariff charged. An analysis has to be done to work out whether a municipality can afford to double or triple the water supply into an area without necessarily increasing its revenue from that area.

On-site Sanitation Questions:

The following questions would only be of relevance if some form of on-site sanitation is being seriously considered as an option.

Is there road access to the site that allows a vacuum tanker within 30m of the potential sites of sanitation facilities? For a vacuum tanker to be used to empty pits it must be able to get within approximately 30m of the sanitation facilities (and not more than two metres above the pit or tank in elevation), otherwise emptying must be carried out by

alternative means (i.e. with tools or machines which can be carried or manhandled to and from the emptying site).

Is there a functioning solid waste disposal service in the area? If there is no solid waste disposal service in the area, it is highly likely that users will use VIP pits for the disposal of at least some of their domestic solid waste. The presence of solid waste in pits makes it much harder to empty pits using suction systems (i.e. some variation of the vacuum tanker). Septic tanks and pour flush latrines are less prone to abuse with solid waste.

Where would waste be disposed of? Whether the waste from pits or septic tanks would be disposed of nearby or far away has major cost implications. Where homes are well spread out there is generally no good reason why faecal waste cannot be simply buried on site in a purpose dug disposal pit, provided such pits are not close to a source of drinking water (more than 30 metres generally provides adequate protection). Waste should be covered by at least 300 mm of soil. Waste can also be composted on site, and this is best done by mixing it with other domestic and garden waste, to ensure that the heap is big enough to get temperatures high enough (60 to 70 degrees) to kill all pathogenic organisms (e.g. ascaris ova, which are particularly hardy at ambient temperatures).

8.3 The *Which San?* Sanitation Planning Model

There is a need for user friendly sanitation decision support software. In the course of this project the *Which San?* Software has been developed to meet this need. *Which San?* enables a user to investigate the social, technical and financial feasibility of any sanitation option. The programme is simple to use, with the user being prompted for data appropriate to the situation in question, and progressively excluding options which are not feasible according to the data provided.

Sample output from worked examples using *Which San?* is included in Appendix C.

The model is available with a user guide and some worked examples from the WRC (www.wrc.org.za/software/whichsan) or from PID at contact@pid.co.za.

8.4 Sanitation Selection Summary

In some instances only one form of sanitation is suitable, but in others there may be several with little to choose between them apart from user preference and cost.

Table 64 summarizes the advantages and disadvantages of the various sanitation options available.

Table 64: Summary of Sanitation Options

SANITATION OPTION	ADVANTAGES	DISADVANTAGES	CAPITAL COST (2008 Rands)	OPERATIONS COST	NOTES
VIP	1. Relatively affordable to operate and maintain 2. Robust in operation. 3. Relatively affordable to build	1. Fills up within 5 to 15 years (depending on design, use and abuse) 2. Difficult, messy and unhygienic to empty 3. Usage of the pit for the disposal of solid waste is common. This accelerates filling of the pit, and can complicate the emptying and the disposal of the sludge.	R4 000 to R6 000	R10 to R30/month, depending on pit emptying arrangements	1. VIPs can be built very simply with locally available building materials, e.g. wattle and daub and reeds, for as little as R1500. The prices indicated here are for the better quality concrete block or concrete pre-cast units. 2. As an alternative to the emptying of waste, a movable structure can be used. When the structure is moved (probably at the householder's expense) a new pit and lining or collar must be built (probably at the WSA's expense)
VIDP	1. Relatively cheap to operate and maintain. 2. Robust in operation. 3. Easier to empty than a VIP as pits are not so deep, and waste is given several years to dry and decompose before it has to be removed.	1. Requires more frequent emptying than do VIPs – typically on a 3 to 6 year cycle, design dependent. 2. Emptying may be easier than a VIP, but still an unpleasant task.	R4 500 to R6 600	R10 to R20/month	Some advise caution that the waste in the pit that is not in use may not dry out as well as hoped due to the tendency for groundwater and seepage from the pit in use to affect it. This concern is overstated. Four to five year old waste, whether wet or dry, is easier to empty than fresh waste.
UD single vault with bucket	1. Easier to empty than a VIP as urine separation ensures drier pit contents. 2. Bucket or tray means that waste can be emptied without handling 3. Cheap to operate and maintain. 4. Waste products, both urine and faeces, have potential usefulness as fertilizer	1. Bucket or tray can be perceived as a return to the bucket system. 2. Requires more user education and acceptance than other sanitation options. 3. User must both keep urine drain clean and functional, and must remove waste on a regular basis. If this is not done, the system cannot work. 4. Helminthic pathogens (worm larvae) are very durable and those emptying waste are exposed to infection.	R4 500 to R6 600	R5/month	

UD double vault	1. Easier to empty than a VIP as urine separation ensures drier pit contents. 2. Urine is a cheap and effective fertilizer 3. Cheap to operate and maintain.	1. Requires more user education and acceptance than other sanitation options. 2. Helminthic pathogens (worm larvae) are very durable and those emptying waste are exposed to infection. 3. Depending on design, emptying of waste is still a messy and unpleasant task.	R5 500 to R7 500	R5/month	Vaults may only need to be emptied once per year, or even less often (design dependent). This makes the UD double vault robust in operation, although when the contents have to be emptied this is a more involved task than is the case for a single vault UD with a tray.
On-site septic tank and soakpit	1. As long as septic tank and soakpit are in good order and not abused, this system offers all the convenience of full waterborne sanitation. 2. If waterborne sanitation is required and a connection to a bulk sewer is not possible, this is the only option.	1. Septic tank has to be pumped out every few years (interval depends on size and number of users). 2. Soakpits, seepage trenches or seepage beds all tend to clog up with time. If they do clog up, new soakpits have to be constructed.	R8 000 to R10 000	R75 to R150/month	Soakpits pose more risk to the groundwater, in terms of possible contamination, than dry on site sanitation systems. Full flush toilets add up to 10 kl per month to a family's water consumption. If toilets leak and this leak is not repaired, the consumption can be even higher.
Pour Flush	1. The pour flush pit is easier to empty than a VIP pit as it cannot be used for disposal of other solid waste. 2. Due to the water seal, the system can be installed inside the house.	1. Cannot be used where there is a high water table or very little soil as some kind of soakpit is required. 2. Soakpit will block up over time and requires maintenance or duplication. Soakpit may be overloaded if not designed for household greywater. 3. Some water (approx. one litre) is required to flush the pan.	R5 000 to R7 000	R20 to R40	This is the most common form of sanitation in South East Asia. Requires water or toilet paper for anal cleansing.
Waterborne sanitation	1. Due to the water seal, this system can be installed inside the house. Waste is flushed away and left to the municipality to deal with. This is therefore the most convenient option to the user, provided the maintenance costs are affordable. 2. This is what most people and politicians regard as the most acceptable form of sanitation	1. Once waterborne sanitation is provided, water consumption per person will increase to 100 to 200 litres per person per day. 2. If any aspect of the system fails (water supply, toilet mechanism, waste water removal and treatment) the potential costs and environmental hazards are high.	R8 000 to R30 000 (depending on adequacy of bulk water supply, bulk sewer network, and existing waste treatment capacity.	R75 to R150/month	Costs can be reduced by adopting the principles of shallow sewerage and/or condominial sewerage. Sewers are laid at a shallower depth, with simpler manholes, and more mid-block sewers are used. The community may enter into a contract to maintain the internal sewer network.

9. CONCLUSIONS AND RECOMMENDATIONS

The focus of the 2001 Sanitation White Paper was on alleviating the negative effects of poor sanitation in society. The effects listed included public health problems, environmental impacts, economic impacts of poor sanitation and social and psychological problems.

Providing financially sustainable sanitation services to a growing population, whilst reducing the backlog of people who do not have access to hygienic sanitation facilities, is a massive challenge at national, provincial, and local government levels. The backlog as at 31 December 2008 was estimated by DWAF as 3 311 512 homesteads without access to adequate sanitation, or approximately 15 million people, which is 30% of the South African population. This backlog is being reduced at a rate of approximately 220 000 units per annum.

A key question is whether the sanitation being provided is working well and whether local government and the beneficiaries are together capable of maintaining these services? In an attempt to throw light on this question, this report includes 18 case studies of different types of sanitation in different provinces, with between 4 and 12 years of operational history. It was found that there was no single type of sanitation that fared uniformly well. For example, at Ntuthokoville in Pietermaritzburg the waterborne sanitation which was provided in 1996 as part of the services upgrade to an informal settlement has worked very well, but the municipality is left carrying bad debts totalling tens of thousands of Rands per home. In Newline, Mpumalanga the VIPs continue to fulfil their function with no significant problems 11 years after construction, whereas at Mbazwana in northern KZN after a similar time period five out of twenty five VIPs inspected had collapsed, and at Inadi fifteen out of twenty-seven inspected were full. The UD toilets at Bereaville, Kammiesberg and eThekwini are generally working well, whereas those at Koel Park and Ekurhuleni have been disastrous. A common lesson is that communal sanitation is very prone to failure (and in this light it is interesting that the Joint Monitoring Programme of the WHO and Unicef do not recognise shared sanitation as meeting minimum improved sanitation requirements).

Another common lesson is that a failure to properly involve the community in the sanitation choice, in the sanitation implementation and in health and hygiene education is likely to result in poor functioning of the resulting latrines.

The report includes the results of a survey of over 1 000 people from poor rural or peri-urban communities, approximately half of whom have to date benefited from government sanitation

projects. Although the new toilets were found in general to be cleaner and freer of flies and odour, it is a concern that there was no difference found between the two groups in the likelihood of a hand washing facility being found near the toilet.

The key design consideration for VIPs is how the management of faecal waste is to be allowed for. A typical pit filling rate is 30 litres per user per year, although significant variability is found in practice. Assuming an average VIP has six users, the sludge accumulation in 10 years will be 1.8 m^3. Allowing some freeboard, a pit should have a capacity of at least 2.5 m^3 if the emptying interval is to be, on average, once every ten years.

The emptying of single pit VIPs can be difficult and hazardous. For this reason planners should rather favour more easily maintained options such as movable VIP toilets (with lightweight top structures), twin pit VIPs (with relatively shallow and therefore more emptyable pits) or single or double pit UD toilets. Pour flush latrines, already very widely used in South East Asia, may provide a more affordable alternative to septic tanks or fully waterborne sanitation. In Asia, however, water is used for anal cleansing and this is important for the success of the pour flush option there. Further work is required to test the feasibility of pour flush or very low flush systems in South Africa.

The funding of the capital cost of new sanitation projects in South Africa is provided by the Municipal Infrastructure Grant. Current cost ceilings allowed for basic sanitation range from R5 000 (for VIP latrines) to R15 000 (for waterborne sanitation), and the contribution from the beneficiaries is usually limited to the digging of the pit, or to nothing at all. Funding for operation and maintenance is required to come from the municipal coffers. Strictly speaking the funding for operation and maintenance is covered by the Equitable Share grant, in terms of which municipalities receive an operations subsidy of between R40 and R60 per month for sanitation for every poor family in their area. However the Equitable Share is an unconditional grant and in practice this is not seen by local government as funding that has to be spent on operation and maintenance of basic services, and a significant portion is used simply to cover the overhead costs of municipal management and administration.

The practice of building sanitation infrastructure while not allowing for adequate maintenance in the future, whether it is basic VIP sanitation or full waterborne sanitation, is short sighted and will result in South Africa facing a sanitation crisis in the medium term. In the next five years South Africa will have at least a million VIP latrines in need of emptying. In the longer term it can be expected that approximately 500 000 VIP latrines will need servicing per year, at an approximate cost (in 2009 Rands) of R600 million Rand per year.

Waterborne sanitation is more popular with users and politicians, but there is a cost. While it is possible to build the on-site structure and the sewer connection and local reticulation for not much more than a VIP latrine (R7 000 to R9 000 per site is a reasonable budget figure), the additional costs of bulk water and bulk sewer provision and the costs of waste water treatment can increase the real cost of waterborne sanitation to well over R30 000 per site.

The cost of operating and maintaining waterborne sanitation is not less than R40 per family per month, but depending on water costs and water use efficiency it can easily be five times as much. In the case of poor families, and half the population in many South African towns and cities are poor, the chances are that this cost will be fully carried by the municipality. If a municipality is unable or unwilling to budget to maintain fully waterborne systems, then it must rather limit itself to dry or semi-dry sanitation systems.

Urine diversion type toilets have proven successful in some cases, but not all. They have two important selling points: the first is that they can be relatively easily managed and maintained by the users themselves; the second is that they allow the users to capture a waste product (urine) which has great value as a liquid fertilizer. However, it was observed in the case studies forming part of this report that this type of sanitation performs particularly poorly in communal settings, and in settings where there has not been acceptance by the users of their role in the maintenance of the system.

Over the years a number of aids have been produced to assist planners with the decision making process required to choose an appropriate basic sanitation option for a given area. These include the *Site Sanitation Planning and Reporting Aid* (SSPRA) produced by Howard et al., 2000, the Norad/DWAF *Decision Making Framework for Municipalities* produced by Holden et al., 2005, and DWAF's *Groundwater Protocol*. There is a need for a software tool that works with the user interactively to progressively eliminate unsuitable sanitation options by asking appropriate questions. There is also a need to combine much of the information required for decision making into one instrument (for example, what is a soil percolation test and how is it carried out?). The *Which San?*[11] programme has been developed under the aegis of this project to go some way towards realising that goal.

[11] Available from the WRC Website www.wrc.org.za/software/whichsan or from contact@pid.co.za.

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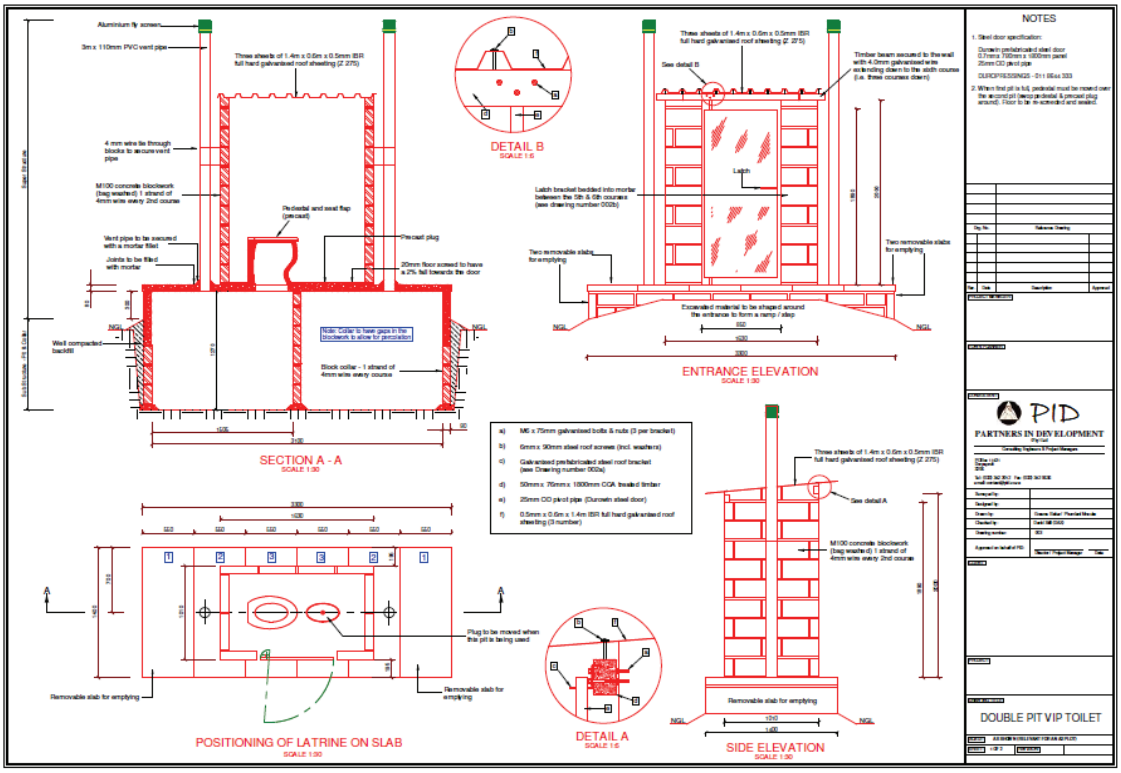
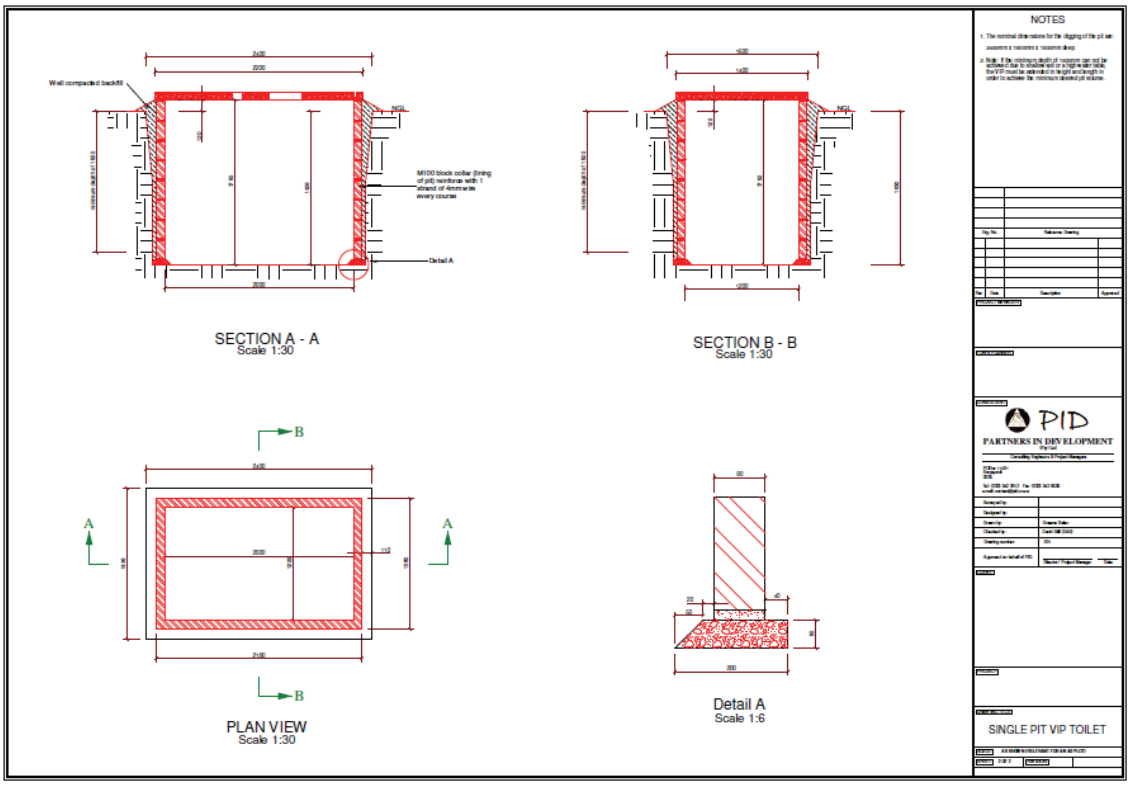
Appendix A:

Detailed drawings and cost sheets for three basic on-site sanitation options:

- **Single Pit VIP**





PID DESIGN - Costing updated in April 09 (excludes VAT)

Note: Quantities are calculated for ordering purposes (wastage / breakages & transport costs allowed for)

Item	Description	Unit	Quantity	Rate	Amount
1	**Pit lining/collar (11.5m^2)**				
1.1	M100 Concrete Blocks	no	147	R3.42	R502.74
1.2	Cement 50 kg pkt (blue)	pkts	1.43	R61.42	R87.83
1.3	Building Sand	m^3	0.230	R203.18	R46.73
1.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.5	R100.32	R50.16
1.5	Concrete foundation – 25 Mpa (0.068 m^3)				
1.5.1	Cement 50 kg pkt (blue)	pkts	0.717	R61.42	R44.04
1.5.2	Umgeni sand	m^3	0.049	R304.00	R14.90
1.5.3	13.2 mm Stone	m^3	0.036	R258.97	R9.32
2	**Floor Slabs - 25 MPA**				
2.1	Cement 50 kg pkt (black)	pkts	2.6	R68.56	R178.26
2.2	Umgeni sand	m^3	0.177	R304.00	R53.81
2.3	13.2 mm Stone	m^3	0.131	R 58.97	R33.93
2.4	Ref 156 Mesh	m^2	3.1	R22.78	R70.62
2.5	Y 8 Reinforcing Rods (6 m) lengths	m	15	R4.90	R73.50
2.6	Spacers	no	24	R0.60	R14.40
2.7	Mould Oil	ml	250.0	R0.03	R7.50
2.8	Plastic	m^2	0.8	R21.42	R17.14
3	**Walls (6.5m^2)**				
3.1	M100 Concrete Blocks	no	83.0	R3.42	R283.86
3.2	Cement 50 kg pkt (blue)	pkts	0.806	R61.42	R49.50
3.3	Building Sand	m^3	0.130	R203.18	R26.41
3.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.5	R100.32	R50.16
4	**Roof**				
4.1	IBR Roof Sheeting (1.4 m x 0.6 m x 5 mm)	no	2	R83.00	R166.00
4.2	Timber beams (2.7 m long – 50 mm x 76 mm)	no	1	R54.51	R54.51
4.3	Roof screws 90 mm	no	12	R0.59	R7.08
5	**Door**				
5.1	Roof Bracket	no	1	R47.82	R47.82
5.2	Wall Bracket	no	1	R54.90	R54.90
5.3	Durowin Prefab Door	no	1	R375.00	R375.00
5.4	M6 x 75 Galv bolts, washers & nuts	no	3	R2.05	R6.15
5.5	32 mm HDPE pipe	sum	1	R2.75	R2.75
6	**Mortar Pedestal**				
6.1	Plaster sand	m^3	0.017	R236.17	R4.01
6.2	Umgeni sand	m^3	0.017	R304.00	R5.17
6.3	Cement (black)	pkts	0.43	R68.56	R29.48
6.4	Lid	no	1	R35.00	R35.00
6.5	Floor wax	sum	1	R2.00	R2.00
6.6	Mould oil	ml	500	R0.03	R15.00
6.7	6 mm wall plugs and screws	no	2	R0.40	R0.80
6.8	2 coats PVA – Infinity white (2 m^2)	sum	1	R5.00	R5.00
6.9	2 coats enamel – Gold label sheen white (2 m^2)	sum	1	R10.00	R10.00
6.10	Turps	ml	50	R0.02	R1.00
6.11	Poly Filla	sum	1	R1.10	R1.10
6.12	Sand Paper	sum	1	R0.55	R0.55
6.13	Paint Brushes	sum	1	R0.66	R0.66

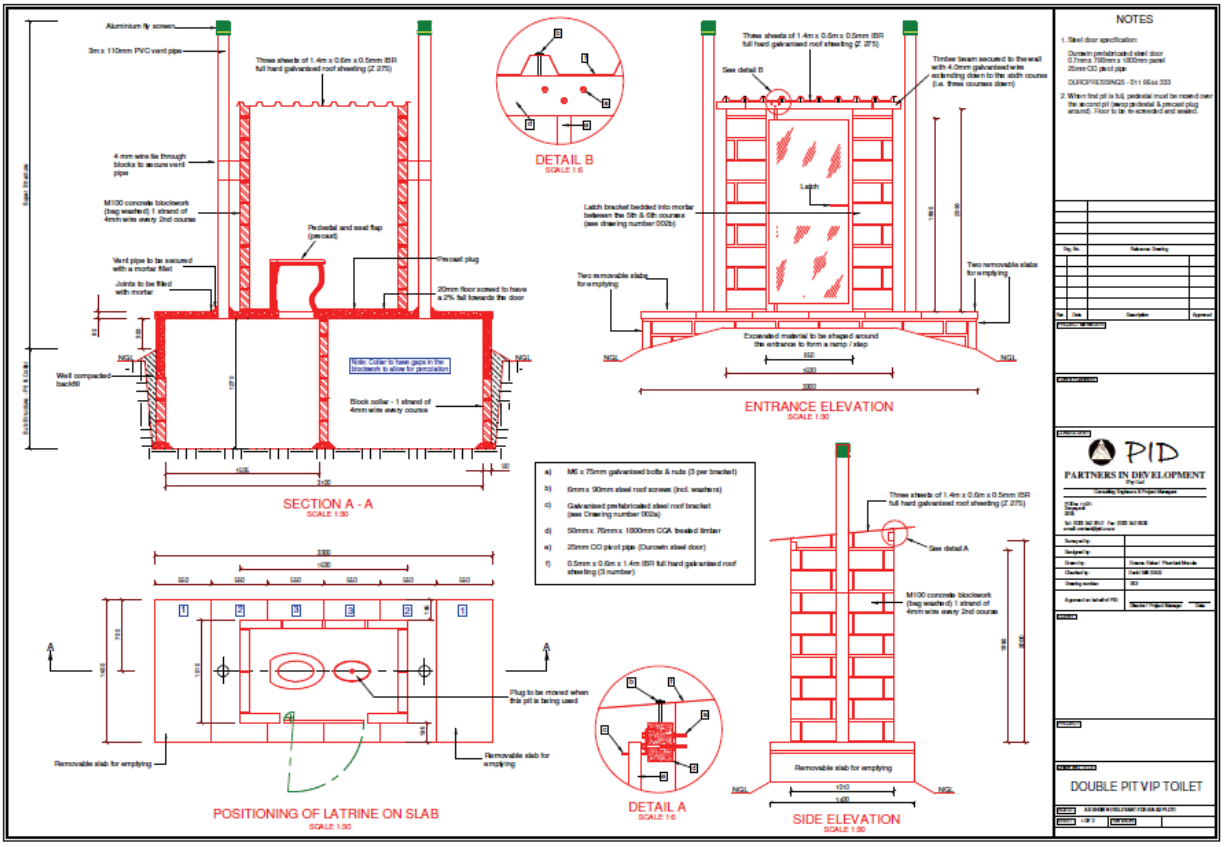
7	**Additional Items & Sundries**				
7.1	110 mm PVC Sewer Pipe (6 m lengths)	no	0.5	R95.00	R47.50
7.2	CSIR Hand Washing Unit	no	1	R27.46	R27.46
7.3	6 mm wall plugs and screws	no	2	R0.40	R0.80
7.4	Aluminium Fly Screen, Binding wire & Putty	sum	1	R4.40	R4.40
7.5	Chevron tape & 2 mm wire (Pit safety)	sum	1	R5.52	R5.52
7.6	CCA Treated wooden stakes (Pit Safety)	sum	1	R2.11	R2.11
7.7	Fertilizer Bags (50 kg – second hand)	no	18	R1.68	R30.24
7.8	2 ℓ Bottles	no	1	R1.60	R1.60
7.9	Adhesive spray - H&H education posters	no	1	R9.38	R9.38
			Subtotal: Material Costs		**R2 567.79**
8	**Labour Costs**				
8.1	Slab Team	no	4	R14.26	R57.04
8.2	Pedestal Team	no	1	R41.58	R41.58
8.3	Transport (Blocks)	no	230	R1.23	R282.90
8.4	Transport Materials from Zone Site	no	1	R425.74	R425.74
8.5	Transport – double handling (inaccessible homes)	no	1	R150.00	R150.00
8.6	Builders	no	1	R617.76	R617.76
8.7	PSC Payments	no	1	R7.50	R7.50
8.8	Pit marking & checking	no	1	R16.63	R16.63
8.9	Health & Hygiene	no	1	R7.13	R7.13
8.10	Security	no	1	R29.48	R29.48
8.11	Baseline Survey	no	1	R11.53	R11.53
8.12	Aggregate preparation	no	18	R1.00	R18.00
			Subtotal: Labour Costs		**R1 665.29**
9.1	Site Staff				
9.1.1	Site manager	sum	1	R133.10	R133.10
9.1.2	General Foreman	sum	2	R72.60	R145.20
9.1.3	General Foreman, Special tasks	sum	1	R72.60	R72.60
9.1.4	ISD Officer	sum	2	R72.60	R145.20
9.1.5	Site clerk	sum	1	R24.20	R24.20
9.1.6	Zone site foreman	sum	1	R60.50	R60.50
9.1.7	General assistants	sum	3	R24.20	R72.60
9.1.8	Travel	sum	1	R284.35	R284.35
9.2	Management team				
9.2.1	Overall Manager	sum	1	R36.30	R36.30
9.2.2	ISD Manager	sum	1	R36.30	R36.30
9.2.3	Technical & Finance manager	sum	1	R133.10	R133.10
9.2.4	Travel	sum	1	R36.30	R36.30
			Subtotal: Management Costs		**R1 179.75**
10	**Zone Site & Disbursements**				
10.1	Zone Site Operation & Maintenance	sum	1	R200.00	R200.00
				Subtotal: Zone & Disbursements	**R200.00**
				TOTAL COST TO BUILD A STANDARD VIP TOILET (ex VAT)	**R5 612.83**

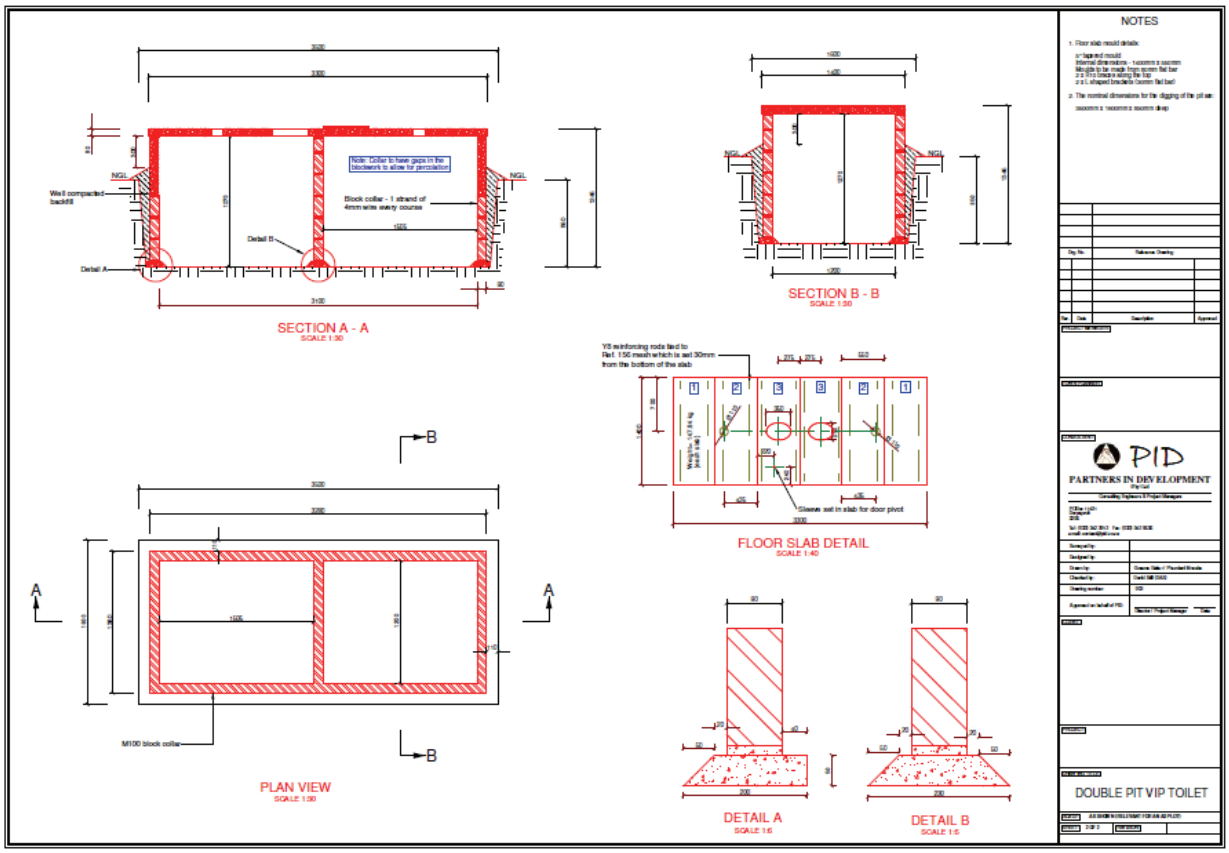
Msunduzi Municipalities current rate per VIP **R4 968.00**

Total aggregate quantities	
Building sand	m^3
Plaster sand	m^3
13.2 mm stone	m^3
Umgeni sand	m^3
Cement	pkts

Total quantities delivered by transport contractors	
Building sand	m^3
13.2 mm stone	m^3
Umgeni sand	m^3
Cement	pkts

- **Double Pit VIP**





COSTING FOR THE CONSTRUCTION OF A DOUBLE PIT VIP TOILET (FULLY LINED)
PID DESIGN - Costing updated in April 09 (excludes VAT)

Note: Quantities are calculated for ordering purposes (wastage / breakages & transport costs allowed for)

Item	Description	Unit	Quantity	Rate	Amount
1	**Pit lining / collar**				
1.1	M100 Concrete Blocks	no	140	R3.42	R478.80
1.2	Cement 50 kg pkt (blue)	pkts	1.10	R61.42	R67.56
1.3	Building Sand	m^3	0.219	R203.18	R44.50
1.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.5	R100.32	R50.16
1.5	Concrete foundation – 25 Mpa (0.068 m^3)				
1.5.1	Cement 50 kg pkt (blue)	pkts	0.871	R61.42	R53.50
1.5.2	Umgeni sand	m^3	0.074	R304.00	R22.50
1.5.3	13.2 mm Stone	m^3	0.054	R258.97	R13.98
2	**Floor Slabs – 25 MPA**				
2.1	Cement 50 kg pkt (black)	pkts	4.2	R68.56	R287.95
2.2	Umgeni sand	m^3	0.354	R304.00	R107.62
2.3	13.2 mm Stone	m^3	0.262	R258.97	R67.85
2.4	Ref 156 Mesh	m^2	6.2	R22.78	R141.24
2.5	Y 8 Reinforcing Rods (6 m) lengths	m	30	R4.90	R147.00
2.6	Spacers	no	48	R0.60	R28.80
2.7	Mould Oil	ml	500.0	R0.03	R15.00
2.8	Plastic	m^2	1.6	R21.42	R34.27
3	**Walls**				
3.1	M100 Concrete Blocks	no	104.0	R3.42	R355.68
3.2	Cement 50 kg pkt (blue)	pkts	0.814	R61.42	R50.00
3.3	Building Sand	m^3	0.163	R203.18	R33.12
3.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.5	R100.32	R50.16
4	**Roof**				
4.1	IBR Roof Sheeting (1.4 m x 0.6 m x 5 mm)	no	3	R83.00	R249.00
4.2	Timber beams (2.7 m long – 50 mm x 76 mm)	no	1	R54.51	R54.51
4.3	Roof screws 90 mm	no	25	R0.59	R14.75
5	**Door**				
5.1	Roof Bracket	no	1	R47.82	R47.82
5.2	Wall Bracket	no	1	R54.90	R54.90
5.3	Durowin Prefab Door	no	1	R375.00	R375.00
5.4	M6 x 75 Galv bolts, washers & nuts	no	3	R2.05	R6.15
5.5	32 mm HDPE pipe	sum	1	R2.75	R2.75
6	**Mortar Pedestal**				
6.1	Plaster sand	m^3	0.017	R236.17	R4.01
6.2	Umgeni sand	m^3	0.017	R304.00	R5.17
6.3	Cement (black)	pkts	0.43	R68.56	R29.48
6.4	Lid	no	1	R35.00	R35.00
6.5	Floor wax	sum	1	R2.00	R2.00
6.6	Mould oil	ml	500	R0.03	R15.00
6.7	6 mm wall plugs and screws	no	2	R0.40	R0.80
6.8	2 coats PVA – Infinity white (2 m^2)	sum	1	R5.00	R5.00
6.9	2 coats enamel - Gold label sheen white (2 m^2)	sum	1	R10.00	R10.00
6.10	Turps	ml	50	R0.02	R1.00
6.11	Poly Filla	sum	1	R1.10	R1.10
6.12	Sand Paper	sum	1	R0.55	R0.55
6.13	Paint Brushes	sum	1	R0.66	R0.66

7	**Additional Items & Sundries**				
7.1	110 mm PVC Sewer Pipe (6 m lengths)	no	1	R95.00	R95.00
7.2	CSIR Hand Washing Unit	no	1	R27.46	R27.46
7.3	6 mm wall plugs and screws	no	2	R0.40	R0.80
7.4	Aluminium Fly Screen, Binding wire & Putty	sum	2	R4.40	R8.80
7.5	Chevron tape & 2 mm wire (Pit safety)	sum	1	R5.52	R5.52
7.6	CCA Treated wooden stakes (Pit Safety)	sum	1	R2.11	R2.11
7.7	Fertilizer Bags (50 kg – second hand)	no	18	R1.68	R30.24
7.8	2 ℓ Bottles	no	1	R1.60	R1.60
7.9	Adhesive spray – H&H education posters	no	1	R9.38	R9.38
8.0	Floor plug	no	1	R100.00	R100.00
				Subtotal: Material Costs	**R3 245.24**
8	**Labour Costs**				
8.1	Slab Team	no	8	R14.26	R114.08
8.2	Pedestal Team	no	1	R41.58	R41.58
8.3	Transport (Blocks)	no	244	R1.23	R300.12
8.4	Transport Materials from Zone Site	no	1	R489.60	R489.60
8.5	Transport – double handling (inaccessible homes)	no	1	R150.00	R150.00
8.6	Builders	no	1	R710.42	R710.42
8.7	PSC Payments	no	1	R7.50	R7.50
8.8	Pit marking & checking	no	1	R16.63	R16.63
8.9	Health & Hygiene	no	1	R7.13	R7.13
8.10	Security	no	1	R29.48	R29.48
8.11	Baseline Survey	no	1	R11.53	R11.53
8.12	Aggregate preparation	no	18	R1.00	R18.00
				Subtotal: Labour Costs	**R1 896.08**
9	**Management Costs / VIP**				
9.1	Site Staff				
9.1.1	Site manager	sum	1	R133.10	R133.10
9.1.2	General Foreman	sum	2	R72.60	R145.20
9.1.3	General Foreman, Special tasks	sum	1	R72.60	R72.60
9.1.4	ISD Officer	sum	2	R72.60	R145.20
9.1.5	Site clerk	sum	1	R24.20	R24.20
9.1.6	Zone site foreman	sum	1	R60.50	R60.50
9.1.7	General assistants	sum	3	R24.20	R72.60
9.1.8	Travel	sum	1	R284.35	R284.35
9.2	Management team				
9.2.1	Overall Manager	sum	1	R36.30	R36.30
9.2.2	ISD Manager	sum	1	R36.30	R36.30
9.2.3	Technical & Finance manager	sum	1	R133.10	R133.10
9.2.4	Travel	sum	1	R36.30	R36.30
				Subtotal: Management Costs	**R1 179.75**

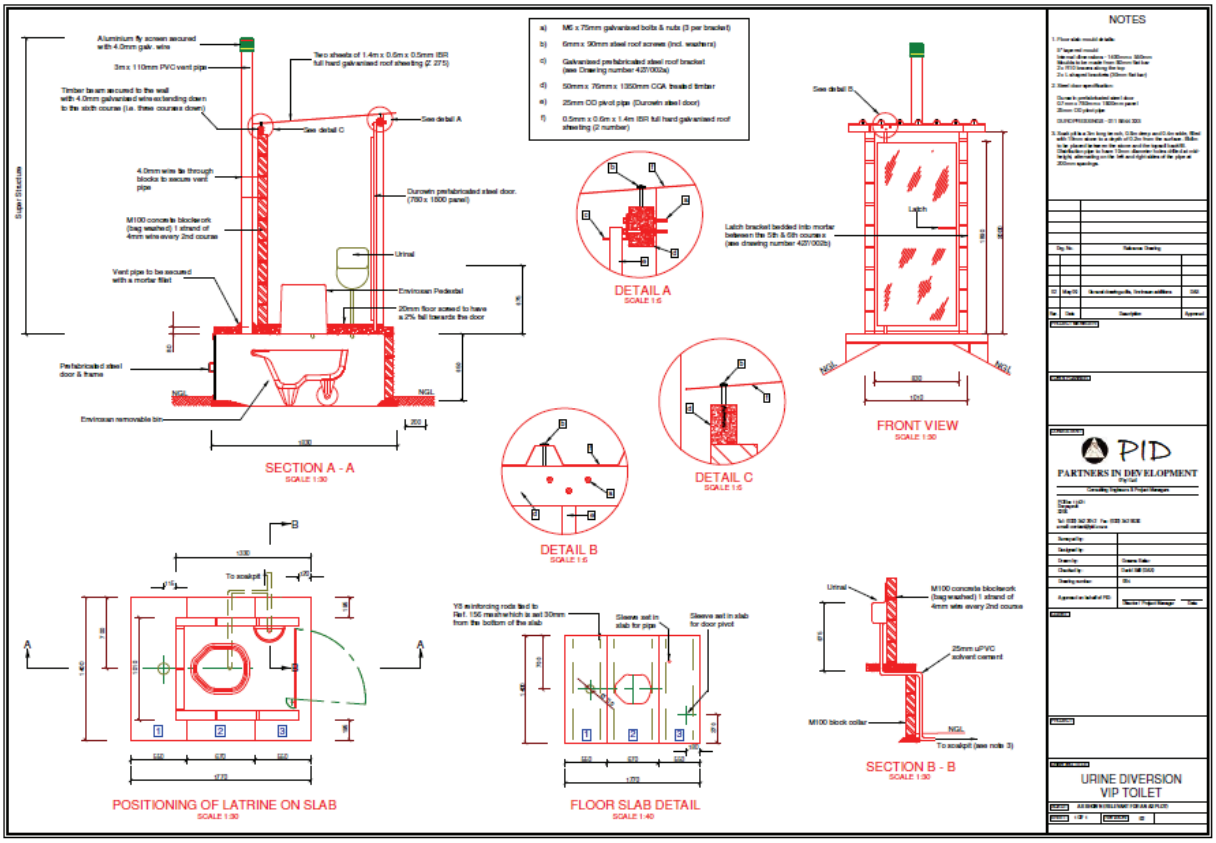
10	**Zone Site & Disbursements**				
10.1	Zone Site Operation & Maintenance	sum	1	R200.00	R200.00
				Subtotal: Zone & Disbursements	**R200.00**
				TOTAL COST TO BUILD A STANDARD VIP TOILET (ex VAT)	**R6 521.06**

Msunduzi Municipalities current rate per VIP **R4 968.00**

Total aggregate quantities	
Building sand	m^3
Plaster sand	m^3
13.2mm stone	m^3
Umgeni sand	m^3
Cement	pkts

Total quantities delivered by transport contractors	
Building sand	m^3
13.2mm stone	m^3
Umgeni sand	m^3
Cement	pkts

- **Urine Diversion VIP Toilet**



COSTING FOR THE CONSTRUCTION OF A URINE DIVERSION VIP TOILET
PID DESIGN - Costing updated in April 09 (excludes VAT)

Note: Quantities are calculated for ordering purposes (wastage / breakages & transport costs allowed for)

Item	Description	Unit	Quantity	Rate	Amount
1	**Pit lining / collar (incl. steps)**				
1.1	M100 Concrete Blocks	no	48	R3.42	R164.16
1.2	Cement 50 kg pkt (blue)	pkts	0.30	R61.42	R18.43
1.3	Building Sand	m^3	0.060	R203.18	R12.19
1.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.2	R100.32	R20.06
1.5	Concrete foundation – 25 Mpa (0.068 m^3)				
1.5.1	Cement 50 kg pkt (blue)	pkts	0.871	R61.42	R53.50
1.5.2	Umgeni sand	m^3	0.074	R304.00	R22.50
1.5.3	13.2 mm Stone	m^3	0.054	R258.97	R13.98
2	**Floor Slabs – 25 MPA**				
2.1	Cement 50 kg pkt (black)	pkts	1.6	R68.56	R109.70
2.2	Umgeni sand	m^3	0.133	R304.00	R40.43
2.3	13.2 mm Stone	m^3	0.100	R258.97	R25.90
2.4	Ref 156 Mesh	m^2	2.3	R22.78	R53.08
2.5	Y 8 Reinforcing Rods (6 m) lengths	m	11.25	R4.90	R55.13
2.6	Spacers	no	18	R0.60	R10.80
2.7	Mould Oil	ml	75.0	R0.03	R2.25
2.8	Plastic	m^2	0.8	R21.42	R17.14
3	**Walls**				
3.1	M100 Concrete Blocks	no	83.0	R3.42	R283.86
3.2	Cement 50 kg pkt (blue)	pkts	0.806	R61.42	R49.50
3.3	Building Sand	m^3	0.130	R203.18	R26.41
3.4	8 Gauge Wire (5 kg roll = 50 m)	no	0.5	R100.32	R50.16
4	**Roof**				
4.1	IBR Roof Sheeting (1.4 m x 0.6 m x 5 mm)	no	2	R83.00	R166.00
4.2	Timber beams (2.7 m long – 50 mm x 76 mm)	no	1	R54.51	R54.51
4.3	Roof screws 90 mm	no	15	R0.59	R8.85
5	**Door**				
5.1	Roof Bracket	no	1	R47.82	R47.82
5.2	Wall Bracket	no	1	R54.90	R54.90
5.3	Durowin Prefab Door	no	1	R375.00	R375.00
5.4	M6 x 75 Galv bolts, washers & nuts	no	3	R2.05	R6.15
5.5	32 mm HDPE pipe	sum	1	R2.75	R2.75
6	**Envirosan products & soak pit**				
6.1	Rotomoulded pedestal	no	1	R462.00	R462.00
6.2	Bin	no	1	R660.00	R660.00
6.3	Flexible hose drain pipe (incl. clamp)	m	5	R15.00	R75.00
6.4	Construct soakpit as per PID drawing. Pit to be 1 m^3 in volulme.	no	1	R250.00	R250.00

7	**Additional Items & Sundries**				
7.1	110 mm PVC Sewer Pipe (6 m lengths)	no	0.5	R95.00	R47.50
7.2	CSIR Hand Washing Unit	no	1	R27.46	R27.46
7.3	6 mm wall plugs and screws	no	2	R0.40	R0.80
7.4	Aluminium Fly Screen, Binding wire & Putty	sum	1	R4.40	R4.40
7.5	Chevron tape & 2mm wire (Pit safety)	sum	1	R5.52	R5.52
7.6	CCA Treated wooden stakes (Pit Safety)	sum	1	R2.11	R2.11
7.7	Fertilizer Bags (50 kg – second hand)	no	18	R1.68	R30.24
7.8	2 ℓ Bottles	no	1	R1.60	R1.60
7.9	Adhesive spray – H&H education posters	no	1	R9.38	R9.38
7.10	Access hatch & frame (to be manufactured)	no	1	R500.00	R500.00
				Subtotal: Material Costs	**R3 821.16**
8	**Labour Costs**				
8.1	Slab Team	no	3	R14.26	R42.78
8.2	Pedestal Team	no		R41.58	R0.00
8.3	Transport (Blocks)	no	131	R1.23	R161.13
8.4	Transport Materials from Zone Site	no	1	R425.74	R425.74
8.5	Transport – double handling (inaccessible homes)	no	1	R150.00	R150.00
8.6	Builders	no	1	R617.76	R617.76
8.7	PSC Payments	no	1	R7.50	R7.50
8.8	Pit marking & checking	no		R16.63	R0.00
8.9	Health & Hygiene	no	1	R7.13	R7.13
8.10	Security	no	1	R29.48	R29.48
8.11	Baseline Survey	no	1	R11.53	R11.53
8.12	Aggregate preparation	no	12	R1.00	R12.00
				Subtotal: Labour Costs	**R1 465.05**
9	**Management Costs / VIP**				
9.1	Site Staff				
9.1.1	Site manager	sum	1	R133.10	R133.10
9.1.2	General Foreman	sum	2	R72.60	R145.20
9.1.3	General Foreman, Special tasks	sum	1	R72.60	R72.60
9.1.4	ISD Officer	sum	2	R72.60	R145.20
9.1.5	Site clerk	sum	1	R24.20	R24.20
9.1.6	Zone site foreman	sum	1	R60.50	R60.50
9.1.7	General assistants	sum	3	R24.20	R72.60
9.1.8	Travel	sum	1	R284.35	R284.35
9.2	Management team				
9.2.1	Overall Manager	sum	1	R36.30	R36.30
9.2.2	ISD Manager	sum	1	R36.30	R36.30
9.2.3	Technical & Finance manager	sum	1	R133.10	R133.10
9.2.4	Travel	sum	1	R36.30	R36.30
				Subtotal: Management Costs	**R1 179.75**

10 10.1	**Zone Site & Disbursements** Zone Site Operation & Maintenance	sum	1	R200.00	R200.00
				Subtotal: Zone & Disbursements	**R200.00**
				TOTAL COST TO BUILD A STANDARD VIP TOILET (ex VAT)	**R6 665.96**

Msunduzi Municipalities current rate per VIP **R4 968.00**

Appendix B:

Tables extracted from the report

The new Local Government Equitable Share Formula and its Impact on Water Services

by Derek Hazelton, tsewater@icon.co.za

THE LOCAL GOVERNMENT EQUITABLE SHARE ALLOCATIONS AND MUNICIPAL DEMOGRAPHICS

This information is extracted from Derek Hazelton's 2009 study *The new Local Government Equitable Share Formula and its Impact on Water Services,* which was carried out as part of WRC project K5-1632 but which is available as a separate report.

Due to space constraints here the data from only KwaZulu-Natal and the Eastern Cape are included. All nine provinces' data appear in Hazelton's report.

CONTENTS

Table B1: Powers and functions of municipalities for ES funded services *Page 1 of 3*

Codes: (new & old)	Name	Town/city: (old names)	2005-06				2009-10				
			Water	Sanitation	Refuse	Electricity	Water	Sanitation	Refuse	Electricity	Municipal health
Details for each municipality											
Eastern Cape											
EC-NMA	Nelson Mandela Bay	Port Elizabeth	1	1	1	1	1	1	1	1	1
EC101	Camdeboo	Graaff-Reinet	1	1	1	1	1	1	1	1	0
EC102	Blue Crane Route	Somerset East	1	1	1	1	1	1	1	1	0
EC103	Ikwezi	Jansenville	1	1	1	1	1	1	1	1	0
EC104	Makana	Grahamstown	1	1	1	1	1	1	1	1	0
EC105	Ndlambe	Port Alfred	1	1	1	1	1	1	1	1	0
EC106	Sundays River Valley	Kirkwood	1	1	1	1	1	1	1	1	0
EC107	Baviaans	Willowmore	1	1	1	1	1	1	1	1	0
EC108	Kouga	Jeffrey's Bay	1	1	1	1	1	1	1	1	0
EC109	Koukamma	Kareedouw	1	1	1	1	1	1	1	1	0
ECDMA10	Aberdeen Plain		-	-	-	-	-	-	-	-	-
ECDC10	Cacadu DM	Port Elizabeth	0	0	0	0	0	0	0	0	1
EC121	Mbhashe	Idutywa	0	0	1	1	0	0	1	1	0
EC122	Mnquma	Butterworth	0	0	1	1	0	0	1	1	0
EC123	Great Kei	Komga	0	0	1	1	0	0	1	1	0
EC124	Amahlathi	Stutterheim	0	0	1	1	0	0	1	1	0
EC125	Buffalo City	East London	1	1	1	1	1	1	1	1	0
EC126	Ngqushwa	Peddie	0	0	1	1	0	0	1	1	0
EC127	Nkonkobe	Fort Beaufort	0	0	1	1	0	0	1	1	0
EC128	Nxuba	Adelaide	0	0	1	1	0	0	1	1	0
ECDC12	Amatole DM	East London	1	1	0	0	1	1	0	0	1
EC131	Inxuba Yethemba	Cradock	0	0	1	1	0	0	1	1	0
EC132	Tsolwana	Tarkastad	0	0	1	1	0	0	1	1	0
EC133	Inkwanca	Molteno	0	0	1	1	0	0	1	1	0
EC134	Lukhanji	Queenstown	0	0	1	1	0	0	1	1	0
EC135	Intsika Yethu	Cofimvaba	0	0	1	1	0	0	1	1	0
EC136	Emalahleni	Lady Frere	0	0	1	1	0	0	1	1	0
EC137	Engcobo	Engcobo	0	0	1	1	0	0	1	1	0
EC138	Sakhisizwe	Cala	0	0	1	1	0	0	1	1	0
ECDMA13	Mountain Zebra National Park		-	-	-	-	-	-	-	-	-
ECDC13	Chris Hani DM	Queenstown	1	1	0	0	1	1	0	0	1
EC141	Elundini	Maclear	0	0	1	1	0	0	1	1	0
EC142	Senqu	Lady Grey	0	0	1	1	0	0	1	1	0
EC143	Maletswai	Aliwal North	0	0	1	1	0	0	1	1	0
EC144	Gariep	Burgesdorp	0	0	1	1	0	0	1	1	0
ECDMA14	Oviston Nature Reserve		-	-	-	-	-	-	-	-	-
ECDC14	Ukhahlamba DM	Barkly East	1	1	0	0	1	1	0	0	1
EC151	Mbizana	Bizana	0	0	1	1	0	0	1	1	0
EC152	Ntabankulu	Tabankulu	0	0	1	1	0	0	1	1	0
EC153	Ngquza Hill	Flagstaff	0	0	1	1	0	0	1	1	0
EC154	Port St Johns	Port St Johns	0	0	1	1	0	0	1	1	0
EC155	Nyandeni	Libode	0	0	1	1	0	0	1	1	0
EC156	Mhlontlo	Qumbu	0	0	1	1	0	0	1	1	0
EC157	King Sabata Dalindyebo	Umtata	0	0	1	1	0	0	1	1	0
ECDC15	O.R. Tambo DM	Umtata	1	1	0	0	1	1	0	0	1
EC05b1	Umzimkhulu	Umzimkulu	0	0	1	1	Refer KZN435				
EC442/05b2	Umzimvubu	Mount Ayliff	0	0	1	1	0	0	1	1	0
EC441/05b3/KZ5a3	Matatiele	Matatiele	n/a	n/a	n/a	n/a	0	0	1	1	0
ECDMA44	O'Connors Camp		-	-	-	-	-	-	-	-	-
ECDC44	Alfred Nzo DM	Mount Ayliff	1	1	0	0	1	1	0	0	1

Table B1: Powers and functions of municipalities for ES funded services *Page 2 of 3*

Codes: (new & old)	Name	Town/city: (old name)	2005-06				2009-10				
			Water	Sanitation	Refuse	Electricity	Water	Sanitation	Refuse	Electricity	Municipal health
Details for each municipality continued											
KwaZulu-Natal											
KZN-ETH	eThekwini	Durban	1	1	1	1	1	1	1	1	1
KZN211	Vulamehlo	Sawoti	0	0	1	1	0	0	1	1	0
KZN212	Umdoni	Scottburgh	0	0	1	1	0	0	1	1	0
KZN213	Umzumbe	Hiberdene	0	0	1	1	0	0	1	1	0
KZN214	uMuziwabantu	Harding	0	0	1	1	0	0	1	1	0
KZN215	Ezinqolweni	Izingolweni	0	0	1	1	0	0	1	1	0
KZN216	Hibiscus Coast	Port Shepstone	0	0	1	1	0	0	1	1	0
KZNDC21	Ugu DM	Port Shepstone	1	1	0	0	1	1	0	0	1
KZN221	uMshwathi	Wartburg	0	0	1	1	0	0	1	1	0
KZN222	uMngeni	Howick	0	0	1	1	0	0	1	1	0
KZN223	Mpofana	Mooi River	0	0	1	1	0	0	1	1	0
KZN224	Impendle	Impendle	0	0	1	1	0	0	1	1	0
KZN225	Msunduzi	Pietermaritzburg	1	1	1	1	1	1	1	1	0
KZN226	Mkhambathini	Camperdown	0	0	0	1	0	0	1	1	0
KZN227	Richmond	Richmond	0	0	1	1	0	0	1	1	0
KZNDMA22	Highmoor/Kamberg Park		-	-	-	-	-	-	-	-	-
KZNDC22	uMgungundlovu DM	Pietermaritzburg	1	1	1	0	1	1	0	0	1
KZN232	Emnambithi/Ladysmith	Ladysmith	0	0	1	1	0	0	1	1	0
KZN233	Indaka	Wasbank	0	0	1	1	0	0	1	1	0
KZN234	Umtshezi	Estcourt	0	0	1	1	0	0	1	1	0
KZN235	Okhahlamba	Bergville	0	0	1	1	0	0	1	1	0
KZN236	Imbabazane	Estcourt	0	0	1	1	0	0	1	1	0
KZNDMA23	Gaints Castle Game Reserve		-	-	-	-	-	-	-	-	-
KZNDC23	Uthukela DM	Ladysmith	1	1	0	0	1	1	0	0	1
KZN241	Endumeni	Dundee	0	0	1	1	0	0	1	1	0
KZN242	Nquthu	Nquthu	0	0	1	1	0	0	1	1	0
KZN244	Msinga	Tugela Ferry	0	0	1	1	0	0	1	1	0
KZN245	Umvoti	Greytown	0	0	1	1	0	0	1	1	0
KZNDC24	Umzinyathi DM	Dundee	1	1	0	0	1	1	0	0	1
KZN252	Newcastle	Newcastle	1	1	1	1	1	1	1	1	0
KZN253	eMadlangeni	Utrecht	0	0	1	1	0	0	1	1	0
KZN254	Dannhauser	Dannhauser	0	0	1	1	0	0	1	1	0
KZNDC25	Amajuba DM	Newcastle	1	1	0	0	1	1	0	0	1
KZN261	eDumbe	Paulpietersburg	0	0	1	1	0	0	1	1	0
KZN262	uPhongolo	Pongola	0	0	1	1	0	0	1	1	0
KZN263	Abaqulusi	Vryheid	0	0	1	1	0	0	1	1	0
KZN265	Nongoma	Nongoma	0	0	1	1	0	0	1	1	0
KZN266	Ulundi	Ulundi	0	0	1	1	0	0	1	1	0
KZNDC26	Zululand DM	Ulundi	1	1	0	0	1	1	0	0	1
KZN271	Umhlabuyalingana	Kwangwane	0	0	1	1	0	0	1	1	0
KZN272	Jozini	Jozini	0	0	1	1	0	0	1	1	0
KZN273	The Big Five False Bay	Hluhluwe	0	0	1	1	0	0	1	1	0
KZN274	Hlabisa	Hlabisa	0	0	1	1	0	0	1	1	0
KZN275	Mtubatuba	Mtubatuba	0	0	1	1	0	0	1	1	0
KZNDMA27	St Lucia Park		-	-	-	-	-	-	-	-	-
KZNDC27	Umkhanyakude DM	Mkhuze	1	1	0	0	1	1	0	0	1
KZN281	Mbonambi	KwaMbonambi	0	0	1	1	0	0	1	1	0
KZN282	uMhlathuze	Richards Bay	1	1	1	1	1	1	1	1	0
KZN283	Ntambanana	Empangeni	0	0	1	1	0	0	0	1	0
KZN284	Umlalazi	Eshowe	0	0	1	1	0	0	1	1	0
KZN285	Mthonjaneni	Melmoth	0	0	1	1	0	0	1	1	0
KZN286	Nkandla	Nkandla	0	0	1	1	0	0	1	1	0
KZNDC28	uThungulu DM	Richards Bay	1	1	0	0	1	1	1	0	1

Table B1: Powers and functions of municipalities for ES funded services *Page 3 of 3*

Codes: (new & old)	Name	Town/city: (old name)	2005-06				2009-10				
			Water	Sanitation	Refuse	Electricity	Water	Sanitation	Refuse	Electricity	Municipal health
Details for each municipality continued											
KwaZulu-Natal continued											
KZN291	Mandeni	Mandini	0	0	1	1	0	0	1	1	0
KZN292	KwaDukuza	Ballito	0	0	1	1	0	0	1	1	0
KZN293	Ndwedwe	Ndwedwe	0	0	1	1	0	0	1	1	0
KZN294	Maphumulo	Maphumulo	0	0	1	1	0	0	1	1	0
KZNDC29	iLembe DM	Stanger	1	1	0	0	1	1	0	0	1
KZN431/5a1	Ingwe	Creighton	0	0	1	1	0	0	1	1	0
KZN432/5a2	Kwa Sani	Himeville	0	0	1	1	0	0	1	1	0
KZ5a3	Matatiele	Matatiele	0	0	1	1	Refer EC441				
KZN433/5a4	Greater Kokstad	Kokstad	0	0	1	1	0	0	1	1	0
KZN434/5a5	Ubuhlebezwe	Ixopo	0	0	1	1	0	0	1	1	0
KZN435/5a6/EC05b1	Umzimkhulu	Umzimkulu	n/a	n/a	n/a	n/a	0	0	1	1	0
KZNDMA43	Mkhomazi Wilderness Area		-	-	-	-	-	-	-	-	-
KZNDC43	Sisonke DM	Ixopo	1	1	0	0	1	1	0	0	1

Note:

Water Services Authorities and their powers and functions are highlighted in ivory

The 2005-06 powers and functions data is not used in the subsequent tables and has only been retained for historical purposes.

Sources:

Municipal names:
Appendices to 2009 Division of Revenue Bills

DMA codes and names:
Stats SA publication: South African Statistics 2004/05

Municipal and DMA codes information:
Gov Gazette, Vol 491, Pta 18May 2006, no 28852 and appendices to 2005 and 2006 Division of Revenue Bills

Town/city old name information:
Adapted from AMEU Website, Association of Municipal Electricity Undertakings, Southern Africa

Powers and functions
2005-06: Appendix to 2005 Division of Revenue Bill
2009-10: Personal communication from DPLG 28 August 2006 and appendix W10 of 2009 Division of Revenue Bill

Table B2: Census 2001 municipal household demographics *Page 1 of 5*

Code	H'hold nos and poverty rates for an R800/mth poverty threshold & Dec 2005 LG Boundaries			Percent poor households served based on Treasury metadata for ES grants and Dec 2005 LG Boundaries				
	Number of households	Poverty rate percent	Number of poor households	Water	Sanitation	Refuse	Electricity	Average for four BSs
National								
RSA	11 205 705	49,4	5 535 783	60,0	40,8	39,3	55,6	49,0
Provincial totals								
EC	1 481 640	63,4	939 780	39,0	29,5	26,9	38,5	33,5
FS	733 302	58,0	425 048	80,3	59,7	50,6	65,9	64,1
GP	2 735 168	35,4	967 540	84,8	73,7	73,8	66,6	74,7
KZN	2 117 274	54,9	1 162 487	45,8	31,5	33,6	45,7	39,2
LIM	1 117 855	66,6	744 677	49,8	11,4	8,5	57,9	31,9
MP	785 433	56,5	444 112	62,1	27,6	24,5	60,4	43,7
NC	245 086	48,2	118 194	75,8	55,6	49,3	60,7	60,4
NW	816 643	54,0	440 731	63,6	32,1	29,9	63,4	47,2
WC	1 173 304	25,0	293 214	83,5	80,3	82,6	71,9	79,6
Metropolitan and DM areas								
Eastern Cape								
EC-NMA	260 799	42,1	109 882	82,6	88,8	79,2	56,8	76,8
ECDC10	100 308	44,1	44 228	79,9	57,7	68,4	60,6	66,6
ECDC12	416 992	64,8	270 249	44,2	30,5	31,0	45,2	37,7
ECDC13	187 330	69,4	130 024	39,1	22,5	19,6	44,1	31,3
ECDC14	84 854	72,6	61 625	35,4	20,1	17,9	36,4	27,5
ECDC15	339 294	74,4	252 497	12,7	9,0	4,6	23,0	12,3
ECDC44	92 063	77,4	71 275	22,8	10,0	5,2	17,7	13,9
KwaZulu-Natal								
KZN-ETH	786 746	40,5	318 605	72,3	53,1	78,3	63,7	66,8
KZNDC21	150 611	63,6	95 838	22,0	20,3	8,7	36,3	21,8
KZNDC22	216 643	51,2	110 875	63,1	36,0	30,0	63,4	48,1
KZNDC23	134 846	67,4	90 902	40,4	20,0	19,0	49,5	32,2
KZNDC24	93 770	73,3	68 777	23,6	48,9	10,9	16,1	24,9
KZNDC25	96 670	60,4	58 435	54,3	4,2	47,1	64,5	42,5
KZNDC26	141 291	68,7	97 080	30,1	18,5	13,9	31,0	23,4
KZNDC27	101 563	69,8	70 875	19,5	14,9	3,5	13,4	12,8
KZNDC28	171 480	57,7	98 867	34,7	22,8	11,1	40,9	27,4
KZNDC29	120 390	62,1	74 782	29,4	23,7	13,7	37,5	26,1
KZNDC43	103 264	75,0	77 451	35,7	19,3	13,3	27,4	23,9

Table B2: Census 2001 municipal household demographics *Page 2 of 5*

Code	H'hold nos and poverty rates for a R800/mth poverty threshold & Dec 2005 LG Boundaries			Percent poor households served based on Treasury metadata for ES grants Dec 2005 LG Boundaries				
	Number of households	Poverty rate percent	Number of poor households	Water	Sanitation	Refuse	Electricity	Average for four BSs
WSA area totals and isolated DMAs								
Eastern Cape								
EC-NMA	260 799	42,1	109 882	82,6	88,8	79,2	56,8	76,8
EC101	10 318	39,4	4 067	96,0	84,3	84,7	76,5	85,4
EC102	9 469	54,1	5 119	77,8	66,3	63,0	54,9	65,5
EC103	2 738	55,0	1 505	95,6	74,5	70,1	64,7	76,2
EC104	18 009	47,6	8 573	81,7	58,1	86,5	62,1	72,1
EC105	15 370	51,1	7 855	73,0	39,4	73,2	54,4	60,0
EC106	9 503	46,9	4 460	67,0	33,8	36,0	61,5	49,6
EC107	3 879	42,5	1 648	92,2	73,4	53,7	66,2	71,4
EC108	19 255	32,8	6 314	80,0	67,6	76,4	62,5	71,6
EC109	9 259	37,6	3 483	83,3	64,7	55,0	65,6	67,1
ECDMA10	2 509	48,0	1 205	67,8	19,9	10,3	21,4	29,9
EC125	188 955	54,0	102 090	70,0	57,9	62,6	48,9	59,9
ECWSA12	228 037	73,7	168 159	28,6	13,8	11,9	42,9	24,3
ECDC13	187 330	69,4	130 024	39,1	22,5	19,6	44,1	31,3
ECDC14	84 854	72,6	61 625	35,4	20,1	17,9	36,4	27,5
ECDC15	339 294	74,4	252 497	12,7	9,0	4,6	23,0	12,3
ECDC44	92 063	77,4	71 275	22,8	10,0	5,2	17,7	13,9
KwaZulu-Natal								
KZN-ETH	786 746	40,5	318 605	72,3	53,1	78,3	63,7	66,8
KZNDC21	150 611	63,6	95 838	22,0	20,3	8,7	36,3	21,8
KZN225	130 292	44,8	58 354	70,4	42,2	41,9	76,0	57,6
KZNWSA22	86 350	60,8	52 522	54,8	29,1	16,9	49,4	37,5
KZNDC23	134 846	67,4	90 902	40,4	20,0	19,0	49,5	32,2
KZNDC24	93 770	73,3	68 777	23,6	48,9	10,9	16,1	24,9
KZN252	71 164	57,0	40 578	67,2	1,4	64,5	77,9	52,7
KZNWSA25	25 507	70,0	17 857	24,8	10,6	7,5	34,1	19,2
KZNDC26	141 291	68,7	97 080	30,1	18,5	13,9	31,0	23,4
KZNDC27	101 563	69,8	70 875	19,5	14,9	3,5	13,4	12,8
KZN282	67 127	44,4	29 818	67,7	35,7	22,0	77,6	50,7
KZNWSA28	104 353	66,2	69 049	20,4	17,3	6,4	25,0	17,3
KZNDC29	120 390	62,1	74 782	29,4	23,7	13,7	37,5	26,1
KZNDC43	103 264	75,0	77 451	35,7	19,3	13,3	27,4	23,9

Table B2: Census 2001 municipal household demographics *Page 3 of 5*

Code	H'hold nos and poverty rates for a R800/mth poverty threshold & Dec 2005 LG Boundaries			Percent poor households served based on Treasury metadata for ES grants Dec 2005 LG Boundaries				
	Number of households	Poverty rate percent	Number of poor households	Water	Sanitation	Refuse	Electricity	Average for four BSs
Details for each metropolitan, local and DMA municipal area:								
Eastern Cape								
EC-NMA	260 799	42,1	109 882	82,6	88,8	79,2	56,8	76,8
EC101	10 318	39,4	4 067	96,0	84,3	84,7	76,5	85,4
EC102	9 469	54,1	5 119	77,8	66,3	63,0	54,9	65,5
EC103	2 738	55,0	1 505	95,6	74,5	70,1	64,7	76,2
EC104	18 009	47,6	8 573	81,7	58,1	86,5	62,1	72,1
EC105	15 370	51,1	7 855	73,0	39,4	73,2	54,4	60,0
EC106	9 503	46,9	4 460	67,0	33,8	36,0	61,5	49,6
EC107	3 879	42,5	1 648	92,2	73,4	53,7	66,2	71,4
EC108	19 255	32,8	6 314	80,0	67,6	76,4	62,5	71,6
EC109	9 259	37,6	3 483	83,3	64,7	55,0	65,6	67,1
ECDMA10	2 509	48,0	1 205	67,8	19,9	10,3	21,4	29,9
EC121	52 886	78,2	41 333	5,4	5,7	1,7	13,0	6,5
EC122	66 843	75,7	50 605	20,8	11,4	14,9	28,2	18,8
EC123	11 365	67,8	7 700	52,6	23,1	17,4	69,5	40,7
EC124	34 303	70,4	24 150	40,2	15,4	12,7	64,3	33,1
EC125	188 955	54,0	102 090	70,0	57,9	62,6	48,9	59,9
EC126	21 634	77,4	16 737	39,5	6,4	1,3	67,5	28,6
EC127	34 457	67,6	23 293	50,8	24,2	20,9	73,5	42,3
EC128	6 549	66,3	4 341	71,9	66,6	50,4	74,4	65,8
EC131	15 982	54,1	8 638	87,9	79,2	72,5	73,9	78,4
EC132	7 830	67,1	5 251	51,2	24,6	21,9	84,5	45,6
EC133	5 385	63,5	3 421	90,3	70,6	68,8	66,7	74,1
EC134	44 264	60,9	26 942	71,5	44,7	41,6	64,4	55,5
EC135	40 489	77,5	31 396	18,0	3,5	1,0	30,3	13,2
EC136	28 033	74,1	20 767	30,1	10,0	8,1	41,0	22,3
EC137	30 882	76,8	23 702	9,2	4,9	1,3	17,2	8,1
EC138	14 446	68,6	9 906	41,6	23,4	21,8	48,0	33,7
ECDMA13	20	0,0	0	n/a	n/a	n/a	n/a	n/a
EC141	33 228	78,9	26 200	16,9	12,1	8,6	8,4	11,5
EC142	33 904	73,7	24 997	36,9	14,4	8,8	58,0	29,5
EC143	9 488	55,1	5 230	68,7	42,9	59,2	41,6	53,1
EC144	8 234	63,1	5 198	88,3	65,2	67,6	68,5	72,4
ECDMA14	0	n/a	0	n/a	n/a	n/a	n/a	n/a
EC151	45 785	80,8	37 011	7,4	7,8	1,0	21,5	9,4
EC152	26 819	80,8	21 670	8,0	5,3	1,2	12,5	6,7
EC153	50 206	78,3	39 311	10,4	6,4	1,1	10,5	7,1
EC154	28 869	78,2	22 567	8,0	5,1	2,0	14,5	7,4
EC155	54 365	76,6	41 646	8,0	4,1	0,7	29,9	10,7
EC156	43 554	74,5	32 442	15,0	6,5	2,0	25,5	12,2
EC157	89 697	64,5	57 850	23,2	19,5	15,7	33,3	22,9
EC05b1	**Ref KZN435**							
EC442	45 453	76,3	34 685	17,6	6,8	4,3	21,1	12,5
EC441	46 610	78,5	36 589	27,7	13,0	6,0	14,5	15,3
ECDMA44	0	n/a	0	n/a	n/a	n/a	n/a	n/a

Table B2: Census 2001 municipal household demographics *Page 4 of 5*

Code	H'hold nos and poverty rates for a R 800/mth poverty threshold & Dec 2005 LG Boundaries			Percent poor households served based on Treasury metadata for ES grants Dec 2005 LG Boundaries				
	Number of households	Poverty rate percent	Number of poor households	Water	Sanitation	Refuse	Electricity	Average for four BSs
Details for each metropolitan, local and DMA municipal area: continued								
KwaZulu-Natal								
KZN-ETH	786 746	40,5	318 605	72,3	53,1	78,3	63,7	66,8
KZN211	15 806	72,5	11 460	12,5	21,4	1,5	16,3	12,9
KZN212	15 287	46,9	7 167	42,8	36,9	21,3	47,4	37,1
KZN213	38 280	76,0	29 079	9,0	16,1	1,3	25,0	12,9
KZN214	19 088	74,4	14 204	23,6	14,6	7,5	21,1	16,7
KZN215	10 684	71,9	7 681	15,9	9,7	1,3	34,2	15,3
KZN216	51 466	51,0	26 248	35,7	26,1	19,2	63,4	36,1
KZN221	23 831	66,5	15 841	51,3	19,7	8,0	49,4	32,1
KZN222	20 486	43,4	8 898	80,9	61,1	49,8	63,1	63,7
KZN223	9 597	59,1	5 673	64,1	50,6	42,0	41,1	49,4
KZN224	7 343	78,1	5 736	63,8	9,8	1,7	60,1	33,9
KZN225	130 292	44,8	58 354	70,4	42,2	41,9	76,0	57,6
KZN226	12 550	65,6	8 232	46,1	25,3	2,5	36,2	27,5
KZN227	12 533	65,0	8 141	29,3	14,6	5,9	46,1	24,0
KZNDMA22	10	10,0	1	100,0	100,0	0,0	0,0	50,0
KZN232	50 529	55,6	28 086	56,1	38,1	40,8	57,1	48,0
KZN233	21 372	82,9	17 726	49,2	15,8	11,6	44,1	30,2
KZN234	13 094	56,6	7 416	52,2	34,1	42,3	47,0	43,9
KZN235	26 678	74,2	19 782	23,2	7,0	2,4	33,3	16,5
KZN236	23 030	77,6	17 879	21,4	4,0	0,9	61,9	22,1
KZNDMA23	144	9,0	13	38,5	30,8	30,8	46,2	36,5
KZN241	12 278	51,7	6 347	80,9	74,5	62,4	51,1	67,2
KZN242	29 318	81,9	24 019	26,5	13,0	6,0	14,1	14,9
KZN244	32 505	77,7	25 259	5,6	5,9	1,2	6,0	4,7
KZN245	19 669	66,9	13 152	25,4	22,6	13,8	22,3	21,0
KZN252	71 164	57,0	40 578	67,2	1,4	64,5	77,9	52,7
KZN253	6 187	61,9	3 828	29,7	49,4	8,6	13,6	25,3
KZN254	19 320	72,6	14 029	23,4	0,0	7,1	39,7	17,6
KZN261	15 107	71,3	10 765	43,1	12,8	24,8	27,0	26,9
KZN262	24 814	68,1	16 892	42,9	12,7	13,8	47,8	29,3
KZN263	35 914	63,4	22 762	41,4	30,9	24,6	31,7	32,1
KZN265	31 581	73,6	23 256	10,6	12,9	2,2	20,7	11,6
KZN266	33 875	69,1	23 404	23,4	18,7	10,1	30,5	20,7
KZN271	25 959	76,6	19 889	12,2	10,1	1,1	3,0	6,6
KZN272	33 534	78,4	26 284	20,1	13,4	4,0	6,4	11,0
KZN273	6 183	63,0	3 894	23,6	20,2	11,2	11,5	16,6
KZN274	26 876	61,4	16 510	15,7	15,2	1,3	25,8	14,5
KZN275	7 472	46,5	3 474	68,7	46,3	16,0	66,0	49,2
KZNDMA27	1 539	53,5	824	21,7	11,2	3,8	22,1	14,7
KZN281	19 143	59,6	11 409	19,6	25,3	5,1	45,6	23,9
KZN282	67 127	44,4	29 818	67,7	35,7	22,0	77,6	50,7
KZN283	12 441	63,0	7 843	14,7	17,1	1,5	26,1	14,8
KZN284	38 446	63,3	24 355	17,9	15,3	5,5	30,8	17,4
KZN285	10 108	72,4	7 319	34,9	24,9	21,0	25,1	26,5
KZN286	24 216	74,8	18 124	20,9	11,7	4,6	3,8	10,2

Table B2: Census 2001 municipal household demographics *Page 5 of 5*

Code	H'hold nos and poverty rates for a R 800/mth poverty threshold & Dec 2005 LG Boundaries			Percent poor households served based on Treasury metadata for ES grants Dec 2005 LG Boundaries				
	Number of households	Poverty rate percent	Number of poor households	Water	Sanitation	Refuse	Electricity	Average for four BSs
Details for each metropolitan, local and DMA municipal area: continued								
KwaZulu-Natal continued								
KZN291	28 952	61,0	17 655	40,3	34,0	17,7	53,0	36,3
KZN292	41 709	47,4	19 769	52,1	30,9	33,3	62,7	44,8
KZN293	27 580	74,0	20 405	19,2	20,8	1,8	18,3	15,1
KZN294	22 149	76,5	16 953	3,8	8,1	1,0	15,0	7,0
KZN431	21 332	78,7	16 797	31,8	12,4	1,4	23,7	17,3
KZN432	4 415	69,6	3 072	63,4	22,4	20,6	27,8	33,5
KZN5a3	Refer EC441							
KZN433	19 625	67,7	13 286	84,5	60,7	58,2	38,3	60,4
KZN434	21 421	75,8	16 239	15,6	14,6	7,2	22,2	14,9
KZN435	36 246	77,1	27 946	23,3	6,1	1,7	27,3	14,6
KZNDMA43	224	50,0	112	82,1	45,5	8,0	47,3	45,8

Note:

The figures in all the columns relate to households living in a housing unit. They are the figures used by Treasury in their LGES formula allocations

A housing unit includes: a house, hut, flat, duplex etc, shack, room, caravan, boat, tent, garage, old bus, etc, but excludes collective living quarter which comprise an institution, hotel, students' residence, home for the aged or workers' hostel

The percentage of poor households served is based on Treasury metadata for ES grant calculations which defines access to services as follows:

- Water: Piped water inside dwelling, inside yard or on community stand distance less than 200m
- Sanitation: Flush toilet (connected to sewerage system), flush toilet (with septic tank), chemical toilet, or bucket latrine. Note: it excludes VIPs on the grounds that the cost of maintenance does not warrant the higher grant allocated for poor households with access to a service
- Refuse removal: Removed by local authority at least once a week
- Electricity: Electricity is the main source of energy for lighting

Sources:

StatsSA Census 2001 metadata on households and housing
StatsSA Census 2001 basic services and household income data supplied to National Treasury in 2006 for LGES grant calculations
Treasury metadata: personal communication

Table B3: LGES formula allocations 2006-07 to 2011-12 *Page 1 of 4*

Code	2006-07 R'000	2007-08 R'000	2008-09 R'000	2009-10 R'000	2010-11 R'000	2011-12 R'000
National totals						
RSA	10 833 945	12 442 802	15 628 721	20 282 738	25 504 539	27 930 463
Provincial totals						
EC	1 791 396	1 957 210	2 412 688	3 135 861	3 914 674	4 268 177
FS	963 942	1 159 339	1 441 035	1 892 248	2 363 252	2 572 554
GP	1 886 749	2 166 608	2 804 268	3 646 865	4 716 618	5 202 453
KZN	2 200 469	2 475 832	3 091 809	3 858 113	4 784 159	5 232 361
LIM	1 338 438	1 561 505	1 941 009	2 583 201	3 212 320	3 509 461
MP	843 987	1 023 506	1 276 515	1 682 355	2 102 418	2 300 700
NC	299 280	347 243	432 017	564 081	705 032	771 302
NW	903 960	1 055 899	1 317 935	1 756 853	2 192 308	2 397 309
WC	605 724	695 661	911 445	1 163 161	1 513 759	1 676 146
Metropolitan and DM area totals						
Eastern Cape						
EC-NMA	240 876	291 588	365 399	456 625	579 518	636 311
ECDC10	111 559	133 037	165 862	214 071	266 932	292 243
ECDC12	503 626	580 598	721 654	936 971	1 169 773	1 265 908
ECDC13	249 964	274 387	340 577	450 392	559 549	611 219
ECDC14	115 576	124 285	154 262	203 643	253 005	276 363
ECDC15	412 542	414 675	515 433	678 274	842 608	920 390
ECDC44	157 253	138 641	149 501	195 885	243 289	265 743
KwaZulu-Natal						
KZN-ETH	623 857	757 069	952 672	1 095 568	1 336 019	1 472 018
KZNDC21	172 000	183 507	228 432	296 317	369 388	403 831
KZNDC22	232 893	264 925	330 733	401 422	507 565	546 492
KZNDC23	165 589	193 226	239 767	314 461	391 537	427 906
KZNDC24	119 544	122 135	151 875	197 480	245 619	268 381
KZNDC25	123 807	147 742	183 359	240 998	300 464	328 441
KZNDC26	176 504	188 746	234 483	309 000	383 885	419 319
KZNDC27	131 889	122 084	151 874	198 560	246 603	269 366
KZNDC28	195 331	199 676	249 349	322 394	402 845	440 570
KZNDC29	137 463	148 319	184 921	240 100	299 736	327 765
KZNDC43	121 592	148 404	184 343	241 813	300 499	328 272

Table B3: LGES formula allocations 2006-07 to 2011-12 *Page 2 of 4*

Code	2006-07 R'000	2007-08 R'000	2008-09 R'000	2009-10 R'000	2010-11 R'000	2011-12 R'000
Details for each municipality						
Eastern Cape						
EC-NMA	240 876	291 588	365 399	456 625	579 518	636 311
EC101	11 302	13 624	16 780	22 369	27 833	30 415
EC102	12 337	14 628	18 007	23 863	29 653	32 394
EC103	4 590	5 370	6 608	8 690	10 793	11 790
EC104	21 225	25 522	31 426	40 617	50 727	55 492
EC105	17 688	21 157	26 066	34 090	42 498	46 467
EC106	10 741	11 786	14 517	19 410	24 128	26 359
EC107	4 797	5 581	6 872	9 114	11 321	12 366
EC108	15 465	18 498	22 905	26 000	32 211	35 510
EC109	8 958	10 412	12 870	17 288	21 501	23 491
ECDMA10	-	-	-	-	-	-
ECDC10	4 456	6 458	9 810	12 629	16 267	17 958
EC121	41 678	35 763	43 954	58 724	72 939	79 668
EC122	48 400	51 740	63 575	85 495	106 272	116 094
EC123	9 445	10 833	13 321	18 239	22 677	24 772
EC124	26 721	31 207	38 357	52 652	65 452	71 493
EC125	213 344	252 125	310 257	392 875	492 572	545 235
EC126	18 325	21 250	26 128	35 842	44 548	48 658
EC127	27 854	32 689	40 176	55 092	68 499	74 825
EC128	6 315	7 353	9 042	12 310	15 311	16 728
ECDC12	111 544	137 639	176 843	225 742	281 503	288 435
EC131	12 270	14 729	18 142	24 840	30 947	33 822
EC132	7 324	8 421	10 353	14 178	17 623	19 250
EC133	5 295	6 091	7 490	10 134	12 599	13 764
EC134	32 727	38 964	47 860	65 663	81 692	89 251
EC135	35 520	31 281	38 455	51 931	64 516	70 468
EC136	20 997	23 190	28 507	38 629	47 997	52 426
EC137	25 588	21 554	26 493	35 482	44 074	48 140
EC138	10 818	12 427	15 272	20 754	25 791	28 171
ECDMA13	-	-	-	-	-	-
ECDC13	99 425	117 729	148 005	188 782	234 310	255 928
EC141	26 913	22 963	28 217	37 565	46 658	50 964
EC142	26 293	30 087	36 984	50 687	62 999	68 811
EC143	6 869	7 846	9 668	13 204	16 433	17 956
EC144	7 506	8 762	10 779	14 614	18 187	19 873
ECDMA14	-	-	-	-	-	-
ECDC14	47 995	54 626	68 613	87 573	108 728	118 759
EC151	35 200	34 369	42 239	56 811	70 572	77 082
EC152	22 799	19 170	23 566	31 401	39 000	42 598
EC153	38 926	33 700	41 412	55 256	68 633	74 966
EC154	24 114	20 375	25 042	33 459	41 557	45 391
EC155	43 438	40 432	49 694	67 224	83 520	91 224
EC156	33 480	31 038	38 147	51 433	63 898	69 793
EC157	55 092	60 441	74 217	100 474	125 001	136 577
ECDC15	159 493	175 150	221 116	282 217	350 428	382 757
EC05b1	Refer KZN435					
EC442	64 636	49 298	40 158	53 930	67 001	73 185
EC441	28 089	32 992	40 562	54 169	67 304	73 520
ECDMA44	-	-	-	-	-	-
ECDC44	64 528	56 350	68 781	87 787	108 984	119 038

Table B3: LGES formula allocations 2006-07 to 2011-12 *Page 3 of 4*

Code	2006-07 R'000	2007-08 R'000	2008-09 R'000	2009-10 R'000	2010-11 R'000	2011-12 R'000
Details for each municipality continued						
KwaZulu-Natal						
KZN-ETH	623 857	757 069	952 672	1 095 568	1 336 019	1 472 018
KZN211	14 045	11 153	13 707	18 334	22 771	24 871
KZN212	8 169	9 502	11 717	15 591	19 505	21 342
KZN213	29 134	27 691	34 035	45 884	56 999	62 256
KZN214	15 676	13 972	17 173	23 011	28 593	31 233
KZN215	10 022	8 261	10 155	13 732	17 060	18 634
KZN216	29 551	34 761	42 816	53 663	67 774	74 351
KZNDC21	65 403	78 168	98 828	126 101	156 686	171 143
KZN221	19 354	18 399	22 630	31 107	38 671	42 241
KZN222	11 171	12 896	16 082	18 958	24 320	26 787
KZN223	7 082	7 565	9 329	12 695	15 796	17 258
KZN224	7 404	7 352	9 041	12 329	15 321	16 734
KZN225	119 512	142 899	176 117	199 824	255 504	284 638
KZN226	11 682	9 186	11 302	15 420	19 164	20 932
KZN227	11 211	9 679	11 909	16 309	20 278	22 151
KZNDMA22	-	-	-	-	-	-
KZNDC22	45 477	56 948	74 323	94 779	118 512	115 750
KZN232	32 360	38 329	47 137	62 342	78 050	85 419
KZN233	17 526	20 126	24 747	33 563	41 700	45 546
KZN234	8 971	10 315	12 691	15 954	20 081	22 012
KZN235	20 346	20 262	24 902	33 756	41 950	45 823
KZN236	18 621	21 566	26 512	36 388	45 223	49 395
KZNDMA23	-	-	-	-	-	-
KZNDC23	67 765	82 627	103 778	132 459	164 532	179 712
KZN241	8 055	9 515	11 743	14 565	18 419	20 215
KZN242	20 975	21 877	26 891	35 889	44 572	48 684
KZN244	27 149	21 208	26 071	34 579	42 939	46 900
KZN245	15 818	13 692	16 837	22 678	28 201	30 810
KZNDC24	47 547	55 841	70 333	89 769	111 487	121 773
KZN252	90 042	110 311	135 603	178 204	222 180	242 927
KZN253	5 528	4 260	5 243	7 025	8 732	9 539
KZN254	14 326	15 653	19 239	26 056	32 385	35 375
KZNDC25	13 911	17 518	23 274	29 712	37 167	40 600
KZN261	12 356	12 147	14 929	20 069	24 935	27 237
KZN262	19 622	19 908	24 474	33 399	41 516	45 349
KZN263	22 589	26 070	32 017	43 602	54 175	59 172
KZN265	25 030	22 491	27 639	37 076	46 053	50 302
KZN266	27 710	25 616	31 470	42 246	52 530	57 390
KZNDC26	69 197	82 514	103 956	132 608	164 676	179 869
KZN271	20 869	16 392	20 145	26 698	33 151	36 208
KZN272	26 310	22 279	27 379	36 360	45 158	49 325
KZN273	6 775	4 364	5 365	7 133	8 857	9 674
KZN274	20 211	17 487	21 486	28 879	35 873	39 181
KZN275	5 898	5 399	6 663	9 077	11 323	12 380
KZNDMA27	-	-	-	-	-	-
KZNDC27	51 826	56 164	70 838	90 412	112 241	122 597
KZN281	14 777	13 832	17 000	23 193	28 823	31 482
KZN282	61 266	72 008	88 852	111 841	140 698	154 205
KZN283	8 894	6 405	7 867	10 787	13 406	14 642
KZN284	30 730	26 260	32 258	43 563	54 172	59 183
KZN285	10 799	8 364	10 283	13 767	17 110	18 691
KZN286	20 897	15 706	19 303	25 532	31 704	34 630
KZNDC28	47 968	57 101	73 788	93 710	116 933	127 737

Table B3: LGES formula allocations 2006-07 to 2011-12 *Page 3 of 4*

Code	2006-07 R'000	2007-08 R'000	2008-09 R'000	2009-10 R'000	2010-11 R'000	2011-12 R'000
Details for each municipality continued						
KwaZulu-Natal continued						
KZN291	19 513	22 188	27 292	37 430	46 560	50 867
KZN292	22 271	25 955	32 191	39 868	50 796	55 846
KZN293	23 444	19 682	24 188	32 439	40 292	44 008
KZN294	18 488	15 326	18 840	25 175	31 266	34 150
KZNDC29	53 747	65 167	82 410	105 188	130 821	142 894
KZN431	18 099	16 065	19 747	26 570	33 008	36 053
KZN432	4 645	3 996	4 919	6 471	8 058	8 808
KZN5a3	Refer EC441					
KZN433	14 589	17 089	21 088	28 093	35 051	38 328
KZN434	17 876	16 114	19 804	26 619	33 073	36 125
KZN435	16 562	27 121	33 335	44 986	55 889	61 045
KZNDMA43	-	-	-	-	-	-
KZNDC43	49 821	68 018	85 448	109 073	135 421	147 914

Notes

Water Services Authorities are highlighted in ivory

The LGES formula allocations comprise: the water, sanitation, refuse, electricity and environmental health basic services grants; and the institutional support grant. The monies allocated before the 2006-07 financial year in terms of the free basic services grants, and the R293 and nodal grants have been discontinued and transferred and integrated into the remaining components.

Sources:

Appendices to 2006, 2007, 2008 and 2009 Division of Revenue Bills (DoRBs)

Table B4: LGES formula allocations 2006-07 to 2011-12 per poor household *Page 1 of 1*

Code	Dec 2005 boundaries: Available cross-subsidy %	Dec 2005 boundaries: Average household income	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
			R/mth per poor household using R 800/mth as the poverty threshold					
National totals								
RSA	28,5	4 084	163	187	235	305	384	420
Provincial totals								
EC	14,8	2 480	159	174	214	278	347	378
FS	17,4	2 599	189	227	283	371	463	504
GP	52,2	6 654	163	187	242	314	406	448
KZN	22,5	3 291	158	177	222	277	343	375
LIM	11,9	1 932	150	175	217	289	359	393
MP	18,3	2 638	158	192	240	316	394	432
NC	24,3	3 372	211	245	305	398	497	544
NW	19,4	2 650	171	200	249	332	415	453
WC	65,3	6 637	172	198	259	331	430	476
Metropolitan and DM area totals								
Eastern Cape								
EC-NMA	36,9	4 593	183	221	277	346	440	483
ECDC10	23,8	3 361	210	251	313	403	503	551
ECDC12	14,1	2 406	155	179	223	289	361	390
ECDC13	9,6	1 665	160	176	218	289	359	392
ECDC14	8,5	1 639	156	168	209	275	342	374
ECDC15	7,8	1 650	136	137	170	224	278	304
ECDC44	6,4	1 359	184	162	175	229	284	311
KwaZulu-Natal								
KZN-ETH	39,4	4 788	163	198	249	287	349	385
KZNDC21	13,6	2 208	150	160	199	258	321	351
KZNDC22	25,4	3 676	175	199	249	302	381	411
KZNDC23	12,1	1 911	152	177	220	288	359	392
KZNDC24	8,8	1 765	145	148	184	239	298	325
KZNDC25	16,8	2 440	177	211	261	344	428	468
KZNDC26	11,2	2 050	152	162	201	265	330	360
KZNDC27	9,9	1 601	155	144	179	233	290	317
KZNDC28	19,8	3 123	165	168	210	272	340	371
KZNDC29	14,0	2 202	153	165	206	268	334	365
KZNDC43	7,8	1 552	131	160	198	260	323	353

Notes

To check which LGES components are included in the formula allocations refer to the notes at the end of table A3

The available cross-subsidies, which are assumed to be derived from domestic customers only, have been calculated by the author using a modelling technique described in annexure B

The boundaries of a number of municipalities changed before the March 2006 LG elections. All the R/mth per poor household calculations have been carried out using the post March 2006 boundaries.

Sources:

The household income bands contained in the information submitted to NT by Statistics South Africa in Dec 2005

Tables A2 and A3 were used to calculate the R/mth per poor household allocations

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 1 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Provincial totals						
EC	645 090	573 827	559 763	1 000 567	85 878	270 736
KZN	802 270	684 000	688 821	1 232 158	120 045	330 818
Metropolitan and DM area totals						
Eastern Cape						
EC-NMA	100 512	105 189	97 949	123 065	13 595	16 314
ECDC10	44 444	36 812	40 455	57 492	5 057	29 812
ECDC12	195 280	166 672	171 140	310 059	24 501	69 319
ECDC13	93 110	75 768	73 049	151 194	11 325	45 946
ECDC14	42 430	34 829	33 832	66 193	5 064	21 296
ECDC15	127 465	120 043	111 479	231 550	20 581	67 157
ECDC44	41 850	34 514	31 859	61 014	5 755	20 893
KZN-ETH	239 583	202 002	251 344	337 719	37 652	27 267
KZNDC21	55 159	53 855	43 775	98 659	9 404	35 465
KZNDC22	87 810	66 759	62 325	135 143	13 298	36 088
KZNDC23	66 021	51 069	49 289	109 135	8 324	30 624
KZNDC24	40 723	37 534	33 260	56 650	5 990	23 322
KZNDC25	47 631	41 441	44 946	80 436	5 531	21 012
KZNDC26	62 470	53 388	50 194	98 239	8 782	35 928
KZNDC27	39 602	36 969	30 728	57 005	6 350	27 905
KZNDC28	62 597	53 902	47 129	107 430	10 624	40 712
KZNDC29	47 173	43 799	36 481	77 057	7 667	27 922
KZNDC43	53 501	43 282	39 351	74 685	6 421	24 572

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 2 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Metropolitan, LM and DMA area totals						
Eastern Cape						
EC-NMA	100 512	105 189	97 949	123 065	13 595	16 314
EC101	4 754	4 373	4 387	6 217	535	3 136
EC102	5 283	4 807	4 672	6 595	493	2 965
EC103	1 773	1 516	1 462	2 116	142	1 954
EC104	8 785	7 210	9 103	11 340	915	5 031
EC105	7 617	5 541	7 630	9 842	791	4 196
EC106	4 209	3 016	3 095	6 086	514	3 484
EC107	1 897	1 646	1 384	2 347	201	2 027
EC108	5 451	4 933	5 300	7 158	827	3 928
EC109	3 734	3 213	2 941	4 906	511	2 971
ECDMA10	939	557	481	884	128	119
EC121	17 796	17 888	17 348	33 126	3 190	10 239
EC122	27 811	24 143	26 537	49 425	4 008	12 030
EC123	6 139	4 371	4 199	11 257	684	3 210
EC124	16 914	12 259	12 255	33 889	2 065	7 795
EC125	92 650	83 328	86 982	116 523	10 675	20 043
EC126	11 628	7 326	6 954	24 137	1 304	5 562
EC127	18 233	13 425	13 352	35 131	2 183	7 970
EC128	4 109	3 932	3 512	6 573	393	2 470
EC131	9 575	8 971	8 437	12 888	946	4 232
EC132	4 271	3 150	3 059	8 613	475	2 866
EC133	3 859	3 316	3 281	4 880	327	2 220
EC134	26 309	20 502	19 865	37 605	2 674	10 219
EC135	17 164	13 513	12 997	31 560	2 450	9 229
EC136	13 367	10 019	9 780	23 472	1 695	6 661
EC137	11 270	10 453	9 862	20 164	1 883	6 882
EC138	7 296	5 843	5 767	12 013	874	3 637
ECDMA13	0	0	0	0	0,9	0,7
EC141	14 123	13 109	12 443	19 584	1 989	7 601
EC142	17 507	12 978	11 906	33 250	2 020	7 625
EC143	5 006	3 916	4 580	5 885	572	3 332
EC144	5 794	4 827	4 902	7 475	483	2 737
ECDMA14	0	0	0	0	0	0
EC151	17 104	17 239	15 326	33 386	2 784	10 010
EC152	10 131	9 655	8 996	17 234	1 623	6 284
EC153	19 129	17 847	16 301	30 345	3 062	10 713
EC154	10 542	10 022	9 514	18 492	1 770	6 667
EC155	19 448	18 156	17 132	41 654	3 305	10 706
EC156	16 987	14 762	13 685	30 771	2 651	8 797
EC157	34 123	32 362	30 526	59 667	5 386	13 979
EC05b1	**Refer KZN435**					
EC442	18 912	15 907	15 275	31 093	2 838	10 358
EC441	22 938	18 608	16 585	29 921	2 917	10 535
ECDMA44	0	0	0	0	0	0

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 3 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Metropolitan, LM and DMA area totals continued **KwaZulu-Natal**						
KZN-ETH	239 583	202 002	251 344	337 719	37 652	27 267
KZN211	5 727	6 540	4 791	9 644	1 043	4 752
KZN212	5 318	4 977	3 948	8 230	976	4 210
KZN213	13 725	15 376	12 111	27 430	2 414	8 315
KZN214	8 360	7 333	6 613	12 721	1 209	4 665
KZN215	4 047	3 664	3 194	8 075	710	3 043
KZN216	17 983	15 965	13 118	32 558	3 052	10 481
KZN221	12 100	8 331	7 439	19 450	1 772	5 369
KZN222	8 785	7 454	5 796	9 954	1 187	3 979
KZN223	4 880	4 303	4 195	6 362	677	2 578
KZN224	4 924	2 589	2 407	7 774	485	2 463
KZN225	46 283	35 441	35 308	73 104	7 139	14 324
KZN226	5 967	4 675	3 504	8 834	1 001	3 732
KZN227	4 869	3 965	3 676	9 665	1 038	3 642
KZNDMA22	1,1	1,1	0,4	0,6	0,4	0,3
KZN232	23 929	19 861	19 595	35 143	3 037	10 166
KZN233	14 119	9 372	8 852	20 709	1 327	5 121
KZN234	6 086	5 010	5 047	8 099	785	3 470
KZN235	11 624	9 060	8 399	20 554	1 726	6 259
KZN236	10 253	7 758	7 386	24 615	1 439	5 600
KZNDMA23	9,3	8,5	8,5	15,4	10,4	8,8
KZN241	6 682	6 353	5 097	6 987	714	3 138
KZN242	14 782	12 160	10 908	19 574	1 834	7 098
KZN244	11 287	11 345	10 493	18 194	2 032	7 765
KZN245	7 973	7 675	6 762	11 895	1 410	5 322
KZN252	37 525	32 829	36 649	61 741	4 027	13 439
KZN253	2 310	1 871	1 810	3 081	386	2 514
KZN254	7 797	6 741	6 487	15 614	1 118	5 059
KZN261	8 048	5 433	6 520	10 389	944	4 017
KZN262	12 603	8 506	8 726	20 418	1 607	5 714
KZN263	16 705	14 790	13 771	23 256	2 215	8 585
KZN265	11 310	11 740	9 840	20 757	1 941	8 239
KZN266	13 804	12 920	11 337	23 420	2 075	9 373
KZN271	9 953	9 610	8 249	13 622	1 607	6 443
KZN272	14 825	13 402	11 503	19 039	2 090	7 920
KZN273	2 306	2 198	1 934	3 056	429	2 573
KZN274	8 724	8 661	6 871	15 723	1 643	7 937
KZN275	3 316	2 690	1 811	4 819	486	2 935
KZNDMA27	478	407	359	746	96	97
KZN281	5 984	6 480	5 097	13 512	1 186	5 522
KZN282	25 963	18 896	15 873	42 481	3 881	11 696
KZN283	3 824	3 969	3 047	7 492	804	3 930
KZN284	12 458	11 998	10 886	24 473	2 575	10 239
KZN285	4 686	4 135	4 198	6 888	732	3 260
KZN286	9 681	8 425	8 028	12 583	1 447	6 065
KZN291	12 666	11 777	9 633	22 321	1 927	7 121
KZN292	16 042	12 712	11 243	23 079	2 419	7 612
KZN293	11 223	11 483	8 581	17 654	1 918	7 842
KZN294	7 242	7 827	7 023	14 003	1 404	5 347

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 4 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
KZN431	11 072	8 454	7 008	15 583	1 323	5 150
KZN432	2 808	1 793	1 724	2 939	275	2 051
KZ5a3	Refer EC441					
KZN433	14 409	11 856	11 309	14 155	1 202	3 693
KZN434	8 584	8 454	7 532	14 767	1 391	5 552
KZN435	16 508	12 638	11 727	27 107	2 210	8 108
KZNDMA43	119,3	86,2	52,4	134,1	19,7	17,4

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 5 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Details for each municipality						
Eastern Cape						
EC-NMA	100 512	105 189	97 949	123 065	13 595	16 314
EC101	4 754	4 373	4 387	6 217	0	2 637
EC102	5 283	4 807	4 672	6 595	0	2 506
EC103	1 773	1 516	1 462	2 116	0	1 822
EC104	8 785	7 210	9 103	11 340	0	4 179
EC105	7 617	5 541	7 630	9 842	0	3 459
EC106	4 209	3 016	3 095	6 086	0	3 005
EC107	1 897	1 646	1 384	2 347	0	1 839
EC108	5 451	4 933	5 300	7 158	0	3 158
EC109	3 734	3 213	2 941	4 906	0	2 494
ECDMA10	-	-	-	-	-	-
ECDC10	939	557	481	884	5 057	4 711
EC121	0	0	17 348	33 126	0	8 251
EC122	0	0	26 537	49 425	0	9 532
EC123	0	0	4 199	11 257	0	2 784
EC124	0	0	12 255	33 889	0	6 508
EC125	92 650	83 328	86 982	116 523	0	13 392
EC126	0	0	6 954	24 137	0	4 750
EC127	0	0	13 352	35 131	0	6 610
EC128	0	0	3 512	6 573	0	2 225
ECDC12	102 630	83 344	0	0	24 501	15 267
EC131	0	0	8 437	12 888	0	3 515
EC132	0	0	3 059	8 613	0	2 506
EC133	0	0	3 281	4 880	0	1 972
EC134	0	0	19 865	37 605	0	8 194
EC135	0	0	12 997	31 560	0	7 373
EC136	0	0	9 780	23 472	0	5 377
EC137	0	0	9 862	20 164	0	5 456
EC138	0	0	5 767	12 013	0	2 974
ECDMA13	-	-	-	-	-	-
ECDC13	93 110	75 768	0	0	11 325	8 578
EC141	0	0	12 443	19 584	0	5 539
EC142	0	0	11 906	33 250	0	5 532
EC143	0	0	4 580	5 885	0	2 739
EC144	0	0	4 902	7 475	0	2 237
ECDMA14	-	-	-	-	-	-
ECDC14	42 430	34 829	0	0	5 064	5 250
EC151	0	0	15 326	33 386	0	8 099
EC152	0	0	8 996	17 234	0	5 170
EC153	0	0	16 301	30 345	0	8 611
EC154	0	0	9 514	18 492	0	5 452
EC155	0	0	17 132	41 654	0	8 438
EC156	0	0	13 685	30 771	0	6 977
EC157	0	0	30 526	59 667	0	10 281
ECDC15	127 465	120 043	0	0	20 581	14 129
EC05b1	**Refer KZN435**					
EC442	0	0	15 275	31 093	0	7 562
EC441	0	0	16 585	29 921	0	7 663
ECDMA44	-	-	-	-	-	-
ECDC44	41 850	34 514	0	0	5 755	5 668

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 6 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Details for each municipality continued						
KwaZulu-Natal						
KZN-ETH	239 583	202 002	251 344	337 719	37 652	27 267
KZN211	0	0	4 791	9 644	0	3 900
KZN212	0	0	3 948	8 230	0	3 413
KZN213	0	0	12 111	27 430	0	6 342
KZN214	0	0	6 613	12 721	0	3 677
KZN215	0	0	3 194	8 075	0	2 463
KZN216	0	0	13 118	32 558	0	7 987
KZNDC21	55 159	53 855	0	0	9 404	7 683
KZN221	0	0	7 439	19 450	0	4 218
KZN222	0	0	5 796	9 954	0	3 208
KZN223	0	0	4 195	6 362	0	2 139
KZN224	0	0	2 407	7 774	0	2 148
KZN225	46 283	35 441	35 308	73 104	0	9 688
KZN226	0	0	3 504	8 834	0	3 083
KZN227	0	0	3 676	9 665	0	2 969
KZNDMA22	-	-	-	-	-	-
KZNDC22	41 527	31 317	0,4	0,6	13 298	8 636
KZN232	0	0	19 595	35 143	0	7 604
KZN233	0	0	8 852	20 709	0	4 002
KZN234	0	0	5 047	8 099	0	2 808
KZN235	0	0	8 399	20 554	0	4 803
KZN236	0	0	7 386	24 615	0	4 387
KZNDMA23	-	-	-	-	-	-
KZNDC23	66 021	51 069	8,5	15,4	8 324	7 021
KZN241	0	0	5 097	6 987	0	2 480
KZN242	0	0	10 908	19 574	0	5 408
KZN244	0	0	10 493	18 194	0	5 891
KZN245	0	0	6 762	11 895	0	4 022
KZNDC24	40 723	37 534	0	0	5 990	5 521
KZN252	37 525	32 829	36 649	61 741	0	9 461
KZN253	0	0	1 810	3 081	0	2 133
KZN254	0	0	6 487	15 614	0	3 954
KZNDC25	10 106	8 612	0	0	5 531	5 463
KZN261	0	0	6 520	10 389	0	3 160
KZN262	0	0	8 726	20 418	0	4 256
KZN263	0	0	13 771	23 256	0	6 575
KZN265	0	0	9 840	20 757	0	6 478
KZN266	0	0	11 337	23 420	0	7 490
KZNDC26	62 470	53 388	0	0	8 782	7 969
KZN271	0	0	8 249	13 622	0	4 827
KZN272	0	0	11 503	19 039	0	5 818
KZN273	0	0	1 934	3 056	0	2 142
KZN274	0	0	6 871	15 723	0	6 286
KZN275	0	0	1 811	4 819	0	2 447
KZNDMA27	-	-	-	-	-	-
KZNDC27	39 602	36 969	359	746	6 350	6 385
KZN281	0	0	5 097	13 512	0	4 584
KZN282	25 963	18 896	15 873	42 481	0	8 628
KZN283	0	0	0	7 492	0	3 295
KZN284	0	0	10 886	24 473	0	8 204
KZN285	0	0	4 198	6 888	0	2 681
KZN286	0	0	8 028	12 583	0	4 921
KZNDC28	36 633	35 007	3 047	0	10 624	8 399

Table B5: Services breakdown of 2009-10 LGES formula allocations *Page 7 of 7*

Code	Water R'000	Sanitation R'000	Refuse R'000	Electricity R'000	Environmental health R'000	Institutional support R'000
Details for each municipality continued						
KwaZulu-Natal continued						
KZN291	0	0	9 633	22 321	0	5 475
KZN292	0	0	11 243	23 079	0	5 546
KZN293	0	0	8 581	17 654	0	6 204
KZN294	0	0	7 023	14 003	0	4 149
KZNDC29	47 173	43 799	0	0	7 667	6 549
KZN431	0	0	7 008	15 583	0	3 980
KZN432	0	0	1 724	2 939	0	1 807
KZ5a3	**Refer EC441**					
KZN433	0	0	11 309	14 155	0	2 630
KZN434	0	0	7 532	14 767	0	4 321
KZN435	0	0	11 727	27 107	0	6 152
KZNDMA43		-	-	-	-	-
KZNDC43	53 501	43 282	52	134	6 421	5 682

Notes

Water Services Authorities are highlighted in ivory

Figures highlighted in ice blue have been abstracted from APPENDIX W10 of the 2009 DoRB

The rest of Table A5 has been calculated as follows:

Unadjusted BS and I allocations were calculated for each municipality using the source material

An overall adjustment factor was calculated for each municipality using a simplified formula: Allocation = (Overall Adjustment Factor) * (Sum unadjusted BS and I Allocations)

The unadjusted BS and I allocations were then multiplied by this overall adjustment factor to obtain the figures in the table

The National; Provincial; and DM area totals were obtained by aggregating the relevant allocations for individual municipalities

The LM and DMA area totals were obtained by distributing the allocations of each DM between its associated LMs (and DMA where relevant) and integrating the distributed allocations with each of the LMs own allocations

Sources:

2009 Division of Revenue Bills (DoRB) Equitable Share Formula Allocations: Appendix E7

2009 DoRB Explanatory memorandum: Annexure E

StatsSA Census 2001 grouped basic services and household income data supplied to National Treasury in 2006 for LGES grant calculations

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 1 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmental health	Institutional support	Totals
Provincial totals							
EC	57,20	50,88	49,64	88,72	7,62	24,01	278,07
KZN	57,51	49,03	49,38	88,33	8,61	23,71	276,57
Metropolitan and DM area totals							
Eastern Cape							
EC-NMA	76,23	79,77	74,28	93,33	10,31	12,37	346,30
ECDC10	83,74	69,36	76,22	108,33	9,53	56,17	403,35
ECDC12	60,22	51,39	52,77	95,61	7,56	21,38	288,92
ECDC13	59,67	48,56	46,82	96,90	7,26	29,45	288,66
ECDC14	57,38	47,10	45,75	89,51	6,85	28,80	275,38
ECDC15	42,07	39,62	36,79	76,42	6,79	22,16	223,86
ECDC44	48,93	40,35	37,25	71,34	6,73	24,43	229,03
KwaZulu-Natal							
KZN-ETH	62,66	52,83	65,74	88,33	9,85	7,13	286,55
KZNDC21	47,96	46,83	38,06	85,79	8,18	30,84	257,66
KZNDC22	66,00	50,18	46,84	101,57	9,99	27,12	301,71
KZNDC23	60,52	46,82	45,18	100,05	7,63	28,07	288,28
KZNDC24	49,34	45,48	40,30	68,64	7,26	28,26	239,27
KZNDC25	67,93	59,10	64,10	114,71	7,89	29,97	343,68
KZNDC26	53,62	45,83	43,09	84,33	7,54	30,84	265,25
KZNDC27	46,56	43,47	36,13	67,03	7,47	32,81	233,46
KZNDC28	52,76	45,43	39,72	90,55	8,95	34,32	271,74
KZNDC29	52,57	48,81	40,65	85,87	8,54	31,12	267,56
KZNDC43	57,56	46,57	42,34	80,36	6,91	26,44	260,18

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 2 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmental health	Institutional support	Totals
Metropolitan, LM and DMA area totals							
Eastern Cape							
EC-NMA	76,23	79,77	74,28	93,33	10,31	12,37	346,30
EC101	97,42	89,61	89,90	127,41	10,97	64,26	479,57
EC102	86,01	78,26	76,06	107,36	8,02	48,28	404,00
EC103	98,19	83,93	80,97	117,16	7,87	108,19	496,30
EC104	85,40	70,08	88,48	110,23	8,89	48,91	411,98
EC105	80,81	58,79	80,94	104,41	8,39	44,51	377,85
EC106	78,66	56,36	57,83	113,72	9,61	65,10	381,27
EC107	95,95	83,25	69,99	118,69	10,18	102,51	480,56
EC108	71,95	65,10	69,95	94,48	10,92	51,85	364,26
EC109	89,35	76,88	70,38	117,39	12,24	71,09	437,31
ECDMA10	64,92	38,51	33,25	61,16	8,82	8,22	214,87
EC121	35,88	36,06	34,98	66,79	6,43	20,64	200,78
EC122	45,80	39,76	43,70	81,39	6,60	19,81	237,06
EC123	66,44	47,31	45,44	121,82	7,40	34,74	323,14
EC124	58,36	42,30	42,29	116,94	7,13	26,90	293,91
EC125	75,63	68,02	71,00	95,11	8,71	16,36	334,84
EC126	57,90	36,48	34,63	120,18	6,49	27,70	283,37
EC127	65,23	48,03	47,77	125,68	7,81	28,51	323,03
EC128	78,88	75,47	67,43	126,17	7,54	47,41	402,91
EC131	92,37	86,54	81,39	124,33	9,13	40,83	434,59
EC132	67,78	50,00	48,55	136,68	7,53	45,48	356,01
EC133	93,98	80,77	79,92	118,87	7,97	54,07	435,59
EC134	81,38	63,41	61,44	116,31	8,27	31,61	362,42
EC135	45,56	35,87	34,50	83,77	6,50	24,49	230,69
EC136	53,64	40,20	39,25	94,19	6,80	26,73	260,80
EC137	39,63	36,75	34,67	70,89	6,62	24,20	212,76
EC138	61,38	49,16	48,52	101,06	7,36	30,59	298,06
ECDMA13	-	-	-	-	-	-	-
EC141	44,92	41,69	39,58	62,29	6,33	24,18	218,98
EC142	58,36	43,27	39,69	110,84	6,73	25,42	284,32
EC143	79,76	62,39	72,98	93,77	9,12	53,09	371,11
EC144	92,89	77,39	78,59	119,84	7,74	43,89	420,34
ECDMA14	-	-	-	-	-	-	-
EC151	38,51	38,82	34,51	75,17	6,27	22,54	215,81
EC152	38,96	37,13	34,59	66,28	6,24	24,17	207,37
EC153	40,55	37,83	34,56	64,33	6,49	22,71	206,46
EC154	38,93	37,01	35,13	68,29	6,54	24,62	210,51
EC155	38,92	36,33	34,28	83,35	6,61	21,42	220,91
EC156	43,63	37,92	35,15	79,04	6,81	22,60	225,15
EC157	49,15	46,62	43,97	85,95	7,76	20,14	253,59
EC05b1	**Refer KZN435**						
EC442	45,44	38,22	36,70	74,70	6,82	24,88	226,76
EC441	52,24	42,38	37,77	68,15	6,64	23,99	231,18
ECDMA44	-	-	-	-	-	-	-

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 3 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmental health	Institutional support	Totals
Metropolitan, LM and DMA area totals continued							
KwaZulu-Natal							
KZN-ETH	62,66	52,83	65,74	88,33	9,85	7,13	286,55
KZN211	41,65	47,56	34,84	70,13	7,59	34,56	236,32
KZN212	61,84	57,87	45,91	95,70	11,34	48,95	321,62
KZN213	39,33	44,06	34,71	78,61	6,92	23,83	227,46
KZN214	49,05	43,02	38,80	74,64	7,09	27,37	239,96
KZN215	43,90	39,75	34,66	87,61	7,71	33,02	246,64
KZN216	57,09	50,69	41,65	103,37	9,69	33,27	295,76
KZN221	63,65	43,83	39,14	102,32	9,32	28,25	286,51
KZN222	82,28	69,81	54,28	93,23	11,11	37,26	347,97
KZN223	71,68	63,20	61,62	93,45	9,94	37,88	337,78
KZN224	71,54	37,60	34,97	112,94	7,05	35,78	299,88
KZN225	66,10	50,61	50,42	104,40	10,19	20,46	302,18
KZN226	60,40	47,32	35,47	89,42	10,13	37,78	280,52
KZN227	49,85	40,59	37,63	98,94	10,62	37,29	274,91
KZNDMA22	95,34	95,34	31,78	50,85	36,85	23,93	334,09
KZN232	71,00	58,93	58,14	104,27	9,01	30,16	331,51
KZN233	66,38	44,06	41,62	97,36	6,24	24,07	279,73
KZN234	68,39	56,30	56,72	91,01	8,82	38,99	320,23
KZN235	48,97	38,17	35,38	86,58	7,27	26,37	242,73
KZN236	47,79	36,16	34,43	114,73	6,70	26,10	265,91
KZNDMA23	59,52	54,34	54,34	98,85	66,90	56,42	390,37
KZN241	87,73	83,42	66,92	91,74	9,37	41,20	380,38
KZN242	51,28	42,19	37,84	67,91	6,36	24,63	230,22
KZN244	37,24	37,43	34,62	60,03	6,71	25,62	201,64
KZN245	50,52	48,63	42,84	75,37	8,93	33,72	260,01
KZN252	77,06	67,42	75,26	126,79	8,27	27,60	382,41
KZN253	50,28	40,73	39,41	67,08	8,40	54,74	260,64
KZN254	46,31	40,04	38,53	92,75	6,64	30,05	254,33
KZN261	62,30	42,06	50,47	80,42	7,31	31,09	273,66
KZN262	62,17	41,96	43,05	100,72	7,93	28,19	284,02
KZN263	61,16	54,15	50,42	85,14	8,11	31,43	290,40
KZN265	40,53	42,07	35,26	74,38	6,95	29,52	228,71
KZN266	49,15	46,00	40,37	83,39	7,39	33,37	259,66
KZN271	41,70	40,27	34,56	57,07	6,73	27,00	207,34
KZN272	47,00	42,49	36,47	60,36	6,63	25,11	218,06
KZN273	49,36	47,05	41,40	65,41	9,18	55,07	267,47
KZN274	44,04	43,72	34,68	79,36	8,29	40,06	250,15
KZN275	79,53	64,51	43,43	115,59	11,65	70,39	385,10
KZNDMA27	48,35	41,22	36,27	75,50	9,76	9,81	220,91
KZN281	43,71	47,33	37,23	98,70	8,66	40,33	275,96
KZN282	72,56	52,81	44,36	118,72	10,85	32,69	331,99
KZN283	40,63	42,17	32,37	79,61	8,54	41,76	245,09
KZN284	42,63	41,05	37,25	83,74	8,81	35,03	248,51
KZN285	53,36	47,08	47,80	78,42	8,33	37,12	272,11
KZN286	44,52	38,74	36,91	57,86	6,65	27,89	212,56
KZN291	59,78	55,59	45,47	105,36	9,10	33,61	308,91
KZN292	67,62	53,58	47,39	97,29	10,20	32,09	308,17
KZN293	45,84	46,90	35,05	72,10	7,83	32,03	239,74
KZN294	35,60	38,48	34,52	68,84	6,90	26,29	210,62

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 4 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmental health	Institutional support	Totals
Metropolitan, LM and DMA area totals continued							
KwaZulu-Natal							
KZN431	54,93	41,94	34,77	77,31	6,56	25,55	241,07
KZN432	76,17	48,65	46,77	79,73	7,47	55,62	314,41
KZ5a3	Refer EC441						
KZN433	90,38	74,37	70,93	88,78	7,54	23,17	355,17
KZN434	44,05	43,38	38,65	75,78	7,14	28,49	237,50
KZN435	49,23	37,69	34,97	80,83	6,59	24,18	233,49
KZNDMA43	88,74	64,16	38,97	99,80	14,67	12,98	319,33

Code	Water	Sanitation	Refuse	Electricity	Environmental health	Institutional support	Totals
Details for each municipality continued							
Eastern Cape							
EC-NMA	76,23	79,77	74,28	93,33	10,31	12,37	346,30
EC101	97,42	89,61	89,90	127,41	0,00	54,04	458,38
EC102	86,01	78,26	76,06	107,36	0,00	40,81	388,50
EC103	98,19	83,93	80,97	117,16	0,00	100,87	481,11
EC104	85,40	70,08	88,48	110,23	0,00	40,62	394,81
EC105	80,81	58,79	80,94	104,41	0,00	36,70	361,65
EC106	78,66	56,36	57,83	113,72	0,00	56,14	362,71
EC107	95,95	83,25	69,99	118,69	0,00	93,03	460,90
EC108	71,95	65,10	69,95	94,48	0,00	41,68	343,16
EC109	89,35	76,88	70,38	117,39	0,00	59,69	413,68
ECDMA10	-	-	-	-	-	-	-
ECDC10	64,92	38,51	33,25	61,16	1,68	1,57	201,08
EC121	0,00	0,00	34,98	66,79	0,00	16,63	118,40
EC122	0,00	0,00	43,70	81,39	0,00	15,70	140,79
EC123	0,00	0,00	45,44	121,82	0,00	30,13	197,38
EC124	0,00	0,00	42,29	116,94	0,00	22,46	181,68
EC125	75,63	68,02	71,00	95,11	0,00	10,93	320,69
EC126	0,00	0,00	34,63	120,18	0,00	23,65	178,46
EC127	0,00	0,00	47,77	125,68	0,00	23,65	197,10
EC128	0,00	0,00	67,43	126,17	0,00	42,72	236,32
ECDC12	50,86	41,30	0,00	0,00	7,56	4,71	104,42
EC131	0,00	0,00	81,39	124,33	0,00	33,91	239,63
EC132	0,00	0,00	48,55	136,68	0,00	39,77	225,00
EC133	0,00	0,00	79,92	118,87	0,00	48,03	246,83
EC134	0,00	0,00	61,44	116,31	0,00	25,34	203,10
EC135	0,00	0,00	34,50	83,77	0,00	19,57	137,84
EC136	0,00	0,00	39,25	94,19	0,00	21,58	155,01
EC137	0,00	0,00	34,67	70,89	0,00	19,18	124,75
EC138	0,00	0,00	48,52	101,06	0,00	25,02	174,60
ECDMA13	-	-	-	-	-	-	-
ECDC13	59,67	48,56	0,00	0,00	7,26	5,50	120,99
EC141	0,00	0,00	39,58	62,29	0,00	17,62	119,48
EC142	0,00	0,00	39,69	110,84	0,00	18,44	168,98
EC143	0,00	0,00	72,98	93,77	0,00	43,63	210,38
EC144	0,00	0,00	78,59	119,84	0,00	35,86	234,29
ECDMA14	-	-	-	-	-	-	-
ECDC14	57,38	47,10	0,00	0,00	6,85	7,10	118,42

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 5 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmen-tal health	Institutional support	Totals
Details for each municipality continued							
Eastern Cape							
EC151	0,00	0,00	34,51	75,17	0,00	18,23	127,91
EC152	0,00	0,00	34,59	66,28	0,00	19,88	120,75
EC153	0,00	0,00	34,56	64,33	0,00	18,25	117,13
EC154	0,00	0,00	35,13	68,29	0,00	20,13	123,55
EC155	0,00	0,00	34,28	83,35	0,00	16,88	134,52
EC156	0,00	0,00	35,15	79,04	0,00	17,92	132,11
EC157	0,00	0,00	43,97	85,95	0,00	14,81	144,73
ECDC15	42,07	39,62	0,00	0,00	6,79	4,66	93,14
EC05b1	**Refer KZN435**						
EC442	0,00	0,00	36,70	74,70	0,00	18,17	129,57
EC441	0,00	0,00	37,77	68,15	0,00	17,45	123,37
ECDMA44	-	-	-	-	-	-	-
ECDC44	48,93	40,35	0,00	0,00	6,73	6,63	102,64

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 6 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmen-tal health	Institutional support	Totals
Details for each municipality continued							
KwaZulu-Natal							
KZN-ETH	62,66	52,83	65,74	88,33	9,85	7,13	286,55
KZN211	0,00	0,00	34,84	70,13	0,00	28,36	133,33
KZN212	0,00	0,00	45,91	95,70	0,00	39,68	181,30
KZN213	0,00	0,00	34,71	78,61	0,00	18,18	131,49
KZN214	0,00	0,00	38,80	74,64	0,00	21,57	135,01
KZN215	0,00	0,00	34,66	87,61	0,00	26,72	148,98
KZN216	0,00	0,00	41,65	103,37	0,00	25,36	170,37
KZNDC21	47,96	46,83	0,00	0,00	8,18	6,68	109,65
KZN221	0,00	0,00	39,14	102,32	0,00	22,19	163,65
KZN222	0,00	0,00	54,28	93,23	0,00	30,04	177,55
KZN223	0,00	0,00	61,62	93,45	0,00	31,42	186,49
KZN224	0,00	0,00	34,97	112,94	0,00	31,21	179,11
KZN225	66,10	50,61	50,42	104,40	0,00	13,84	285,36
KZN226	0,00	0,00	35,47	89,42	0,00	31,20	156,09
KZN227	0,00	0,00	37,63	98,94	0,00	30,39	166,95
KZNDMA22	-	-	-	-	-	-	-
KZNDC22	65,89	49,69	31,78	50,85	9,99	6,49	214,69
KZN232	0,00	0,00	58,14	104,27	0,00	22,56	184,97
KZN233	0,00	0,00	41,62	97,36	0,00	18,81	157,79
KZN234	0,00	0,00	56,72	91,01	0,00	31,55	179,28
KZN235	0,00	0,00	35,38	86,58	0,00	20,23	142,20
KZN236	0,00	0,00	34,43	114,73	0,00	20,45	169,61
KZNDMA23	-	-	-	-	-	-	-
KZNDC23	60,52	46,82	54,34	98,85	7,63	6,44	274,60
KZN241	0,00	0,00	66,92	91,74	0,00	32,56	191,23
KZN242	0,00	0,00	37,84	67,91	0,00	18,76	124,52
KZN244	0,00	0,00	34,62	60,03	0,00	19,44	114,08
KZN245	0,00	0,00	42,84	75,37	0,00	25,48	143,69
KZNDC24	49,34	45,48	0,00	0,00	7,26	6,69	108,77
KZN252	77,06	67,42	75,26	126,79	0,00	19,43	365,97
KZN253	0,00	0,00	39,41	67,08	0,00	46,44	152,94
KZN254	0,00	0,00	38,53	92,75	0,00	23,49	154,77
KZNDC25	47,16	40,19	0,00	0,00	7,89	7,79	103,03
KZN261	0,00	0,00	50,47	80,42	0,00	24,46	155,35
KZN262	0,00	0,00	43,05	100,72	0,00	20,99	164,77
KZN263	0,00	0,00	50,42	85,14	0,00	24,07	159,63
KZN265	0,00	0,00	35,26	74,38	0,00	23,21	132,85
KZN266	0,00	0,00	40,37	83,39	0,00	26,67	150,42
KZNDC26	53,62	45,83	0,00	0,00	7,54	6,84	113,83
KZN271	0,00	0,00	34,56	57,07	0,00	20,23	111,86
KZN272	0,00	0,00	36,47	60,36	0,00	18,45	115,28
KZN273	0,00	0,00	41,40	65,41	0,00	45,85	152,66
KZN274	0,00	0,00	34,68	79,36	0,00	31,73	145,77
KZN275	0,00	0,00	43,43	115,59	0,00	58,68	217,70
KZNDMA27	-	-	-	-	-	-	-
KZNDC27	46,56	43,47	36,27	75,50	7,47	7,51	216,77
KZN281	0,00	0,00	37,23	98,70	0,00	33,48	169,41
KZN282	72,56	52,81	44,36	118,72	0,00	24,11	312,56
KZN283	0,00	0,00	0,00	79,61	0,00	35,01	114,62
KZN284	0,00	0,00	37,25	83,74	0,00	28,07	149,06
KZN285	0,00	0,00	47,80	78,42	0,00	30,53	156,75
KZN286	0,00	0,00	36,91	57,86	0,00	22,63	117,40
KZNDC28	44,21	42,25	32,37	0,00	8,95	7,08	134,87

Table B6: Services breakdown of 2009-10 LGES formula allocations R/poor household per month for R 800/mth poverty threshold *Page 7 of 7*

Code	Water	Sanitation	Refuse	Electricity	Environmen-tal health	Institutional support	Totals
Details for each municipality continued							
KwaZulu-Natal continued							
KZN291	0,00	0,00	45,47	105,36	0,00	25,84	176,67
KZN292	0,00	0,00	47,39	97,29	0,00	23,38	168,06
KZN293	0,00	0,00	35,05	72,10	0,00	25,34	132,48
KZN294	0,00	0,00	34,52	68,84	0,00	20,39	123,75
KZNDC29	52,57	48,81	0,00	0,00	8,54	7,30	117,22
KZN431	0,00	0,00	34,77	77,31	0,00	19,74	131,82
KZN432	0,00	0,00	46,77	79,73	0,00	49,01	175,51
KZ5a3	Refer EC441						
KZN433	0,00	0,00	70,93	88,78	0,00	16,50	176,21
KZN434	0,00	0,00	38,65	75,78	0,00	22,18	136,60
KZN435	0,00	0,00	34,97	80,83	0,00	18,35	134,15
KZNDMA43	-	-	-	-	-	-	-
KZNDC43	57,56	46,57	38,97	99,80	6,91	6,11	255,94

Appendix C:

Aids to planning and selecting appropriate sanitation systems

AIDS TO PLANNING AND SELECTING APPROPRIATE SANITATION SYSTEMS

There are several tools that exist to assist the decision-maker in the selection of appropriate and sustainable sanitation options. These tools are decision-making frameworks that prompt the user to take into account all the necessary factors.

C.1 Site Sanitation Planning and Reporting Aid (SSPRA)

The upgrading of sanitation is more than a purely technical exercise. The technical issues are now being regarded as a pre-feasibility assessment, with the decision about technology type resting in a range of people-centred issues. Howard *et al*. (2000) designed the Site Sanitation Planning and Reporting Aid (SSPRA) to assist in such decision making.

The primary purpose of SSPRA was to provide local authorities, service organisations and development agencies with a framework in which information could be recorded in a consistent manner. The designers make it clear that the SSPRA is not a decision making tool or a replacement for the broader sanitation planning process. Howard *et al*. (2000) state that 'no single tool can hope to address all the issues which need to be taken into account in such a complex process, particularly where decision making is always to some extent based on the subjective judgement of several parties and on incomplete information.'

The SSPRA consists of the following four components:

- A Regional Sanitation Zoning Map
- A WINDOWS based planning and reporting aid
- A list of specialist consultants
- An option of technology design modification.

These components constitute stages in a process; the first two stages run concurrently followed by stages 3 and 4. The context of the SSPRA process in the broader sanitation planning process is highlighted in Table D1.

Table C1 Context of the SSPRA in the broader sanitation planning process (after Howard *et al.,* 2000)

Level of Planning	Methodology/ Tool	Context
1. Regional (catchment)	Regional Zoning Map	Input to development planning and implementation process
2. Local (project)	Project Cycle Management, incorporating health and sanitation transformation methodology (PHAST)	Management of overall process of development planning and implementation
3. Site (household plot/ group of plots)	SSPRA technology	Input to development planning and implementation process

Stage 1 of the SSPRA, a Regional Sanitation Zoning Map, defines zones of suitability for specific technologies and should be composed for that area under the jurisdiction of the planning authority/service provider. This should be carried out prior to proceeding with the planning and reporting aid for site-based sanitation planning and technology selection. The Regional Sanitation Zoning Map may be composed of the following data:

- Slope
- Proximity to boreholes
- Proximity to high loading sanitation systems
- Proximity to other development projects
- Population density
- Soil characteristics
- Per capita household income
- Proximity to existing services
- Local authority boundaries

The formulation of the Regional Sanitation Zoning Map is coupled with entering information in a database called a planning and reporting aid. The planning and reporting aid includes:

- User information on site location and site description
- Checklists designed to identify the extent to which various fundamental requirements for sanitation planning have been met
- Indices for Technology Selection
- Recommendations and reporting from the input of the user.

The specialist consultation network is included in the SSPRA to provide additional decision support to the users of the SSPRA. The specialists will also provide assistance should the result from employing the SSPRA be inconclusive. The design modification would occur when the previous three stages of the SSPRA have not given a satisfactory outcome. The most appropriate option is selected and then modified to accommodate the unique site specific conditions (Howard *et al*., 2000).

C.2 Ecological Sanitation Selection Algorithm

Drangert (2005) proposed a tool for selecting sustainable sanitation arrangements and characterised the parameter criteria for a sanitation selection algorithm. The criteria are:

- Environmental management criteria – wastewater quality, reuse of used materials and resource conservation
- Technical management criteria – engineering design, density of buildings, existing sanitation arrangements, health and hygiene requirements
- Social management criteria – social acceptability and capacity to manage the arrangement
- Economic management criteria – cost and affordability

The criteria listed are used as a basis for selecting an appropriate sanitation option. The following sequence of questions was used by Drangert (2005) to characterise the selection algorithm:

- Is there an aim/policy of reuse or sustainability?
- Is the wastewater quality considered a major concern/problem?
- Is there enough space and infiltration/evaporation capacity on site?
- Is poor waste water quality caused by compounds other than excreta?
- Is the treatment on site effective and affordable?
- Is diversion of urine an affordable option?
- Can faecal matter be composted on site?
- Can urine be stored and used on site?

The algorithm provides a tool to organise the selection process of a sanitation arrangement and allows comparisons of options.

C.3 NORAD/DWAF Decision Making Framework for Municipalities

Holden *et al.* (2005) have developed a 'Decision Making Framework for Municipalities' (which is Number 7.3 in the NORAD funded Toolkit for Water Services produced by DWAF in 2005). The framework includes decision trees for the following: water resources (both water treatment and pumping), water demand (water usage, water loss, sanitation, water demand management) and affordability. The decision tree for sanitation is shown in Figure D1.

The framework was designed to be used by municipalities to run public discussions on appropriate service solutions and for municipal officials and councillors when deciding how to provide services to their residents. The framework guides users through a number of important factors associated with providing water services. If a decision cannot be made because there is lack of information the framework informs the user that more information is required for the process to continue (Holden et al., 2005).

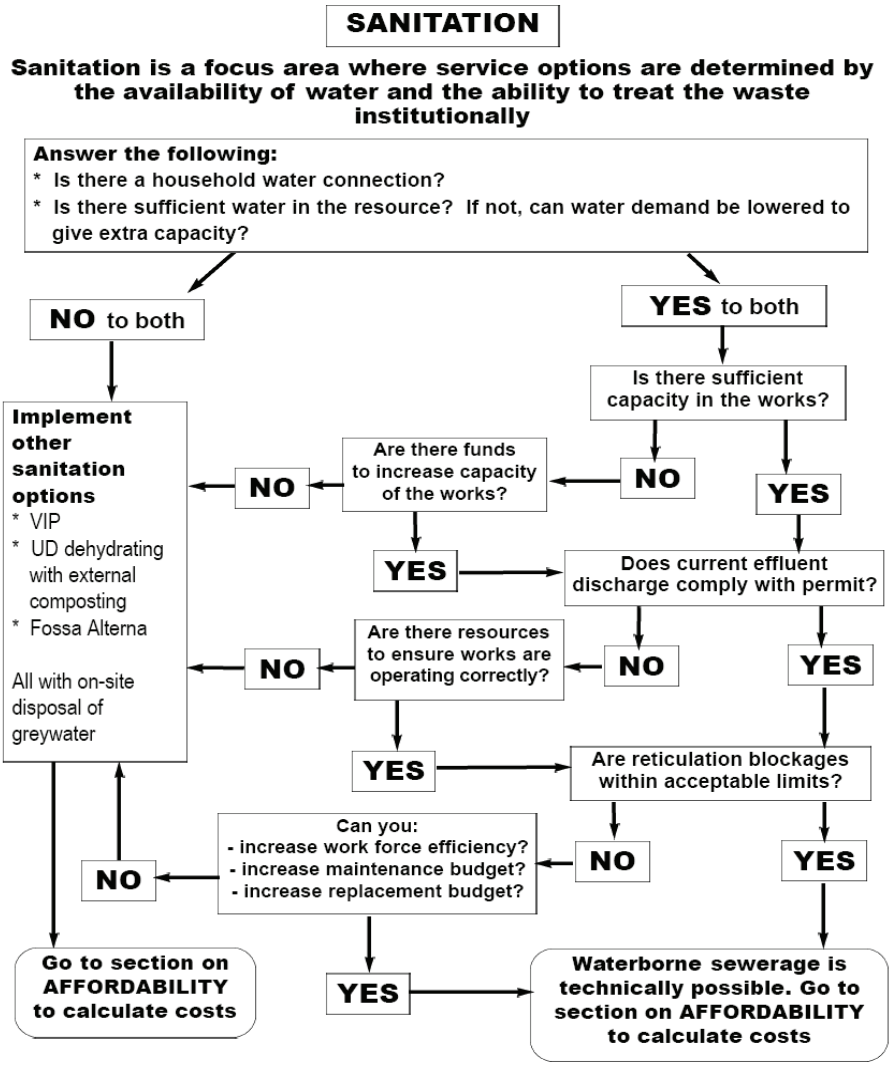


Figure C1 Decision tree for sanitation selection (after Holden *et al.,* 2004)

C.4 DWAF Groundwater Protocol

Ventilated improved pit latrines (VIP) systems are often deemed the suitable sanitation option for rural and peri-urban sanitation programmes. There are, however, concerns regarding contamination of groundwater from pit latrines. In response to the concerns DWAF (1997) developed a protocol to manage the potential of contamination from onsite sanitation. The protocol has the following steps:

- Step 1: Groundwater potential assessment
- Step 2: Evaluation of groundwater use
- Step 3: Assessment of flag situations
- Step 4: Evaluation of pollution risk to the groundwater resource
- Step 5: Evaluation of measures to reduce the risk
- Step 6: Implementation of risk reduction measures

The protocol to assess potential groundwater contamination from VIPs could constitute part of a technical assessment in other decision-making frameworks for the selection of appropriate sanitation options.

C.5 Which San? Software

There is a need for user friendly sanitation decision support software. In the course of this project the *Which San?* Software has been developed to meet this need. *Which San?* enables a user to investigate the social, technical and financial feasibility of any sanitation option. The programme is simple to use, with the user being prompted for data appropriate to the situation in question, and progressively excluding options which are not feasible according to the data provided.

The model is available with a user guide and some worked examples from the WRC (www.wrc.org.za/software/whichsan) or from PID at contact@pid.co.za.

Appendix D:

The Cost of Wastewater Treatment

A discussion by Francisca Bakker and Dr Andre van Niekerk of Golder and Associates

Note: The costs referred to in this discussion are in 2006 Rands. Adjust by approximately 1.3 to get to 2009 Rands.

3 COST OF WASTEWATER TREATMENT

3.1 Indicative capital cost

The capital investment cost for wastewater treatment plants depends on several technology driven and site driven variables. The most important factors influencing the total constructed cost of a wastewater treatment plant are as follows:

- The treatment technology selected for the project. Some technologies are more capital intensive than others.
- The available infrastructure on the site, including site services and common unit treatment processes such as screening/grit removal, which may be shared between the existing treatment module and the new treatment model.
- The characteristics of the treatment plant site will impact on capital cost depending on certain features such as:
  - Slope of the site will determine the number of wastewater pumping stages.
  - Ground conditions on site, specifically the presence of rock (requiring expensive excavation techniques) and problem soils (requiring specialised foundation construction).
- Discharge standards will, for example, determine the need to incorporate more capital intensive treatment infrastructure to remove Nitrogen and Phosphorus.
- Sludge disposal approach will determine the degree of sludge stabilisation and disinfection. For example, the new South African Sludge Guidelines stipulate a high level of stabilisation for certain classes of sludge, which will require additional digester facilities.
- On-site facilities required by the treatment plant owner, such as laboratory facilities, staff accommodation, access roads, security fencing, etc.

Some indicative capital investment costs were extracted from recently constructed wastewater treatment plants in the micro, small to medium size range. There is a substantial variation in treatment plant costs due to the factors listed above and for that reason it is prudent rather to give an envelope of capital costs, than a single median line. The capital cost curves therefore indicate a lower 25 percentile, a media 50 percentile and an upper 75 percentile cost. The capital cost per unit of treatment capacity (R million pre Mℓ/day plant capacity) is also sensitive to the size of the plant. The larger treatment plants have a scale benefit in terms of capital investment.

The indicative capital investment cost curves were developed for the main types of secondary treatment technologies as reflected below:

- **Activated sludge treatmen**t incorporating preliminary treatment, BNR type activated sludge, secondary clarification, disinfection, sludge drying beds and associated plant infrastructure - refer to **Figure 29**.

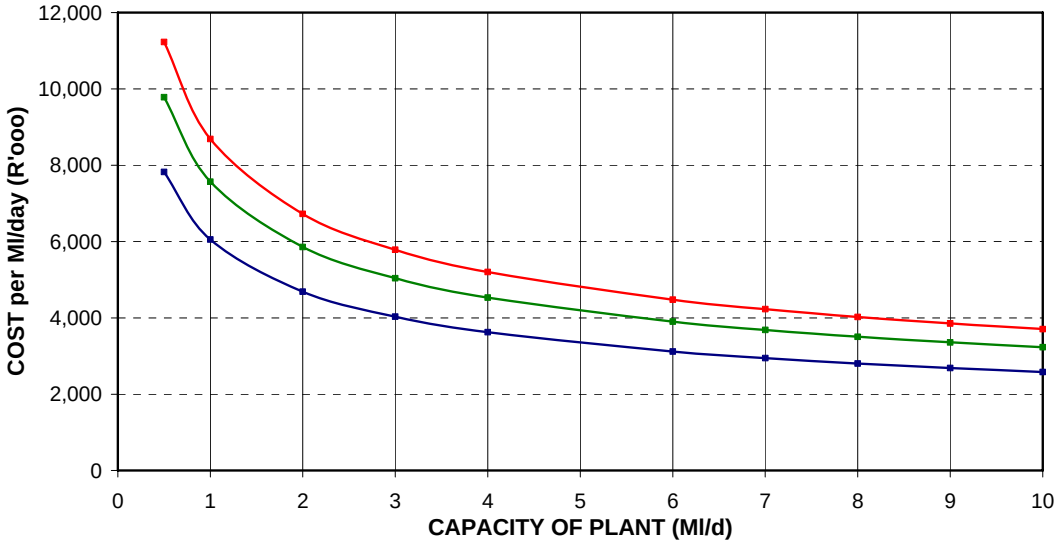


Figure 29 : Capital Investment Cost curves for the Activated Sludge Treatment Plants

- **Trickling filter treatment** incorporating preliminary treatment, primary clarification trickling filters, humus clarifiers, disinfection, sludge digestion and sludge drying beds - refer to **Figure 30**.

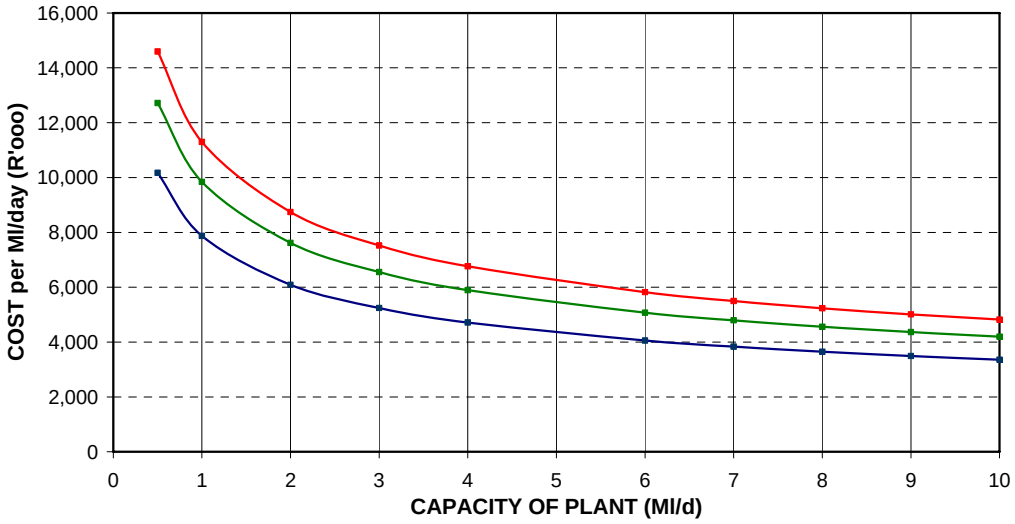


Figure 30 : Capital Investment Cost Curves for Trickling Filtration Treatment Plants

- **Integrated pond treatment** incorporating preliminary treatment, integrated ponds, polishing wetlands and side-stream nitrification Biotowers - refer to **Figure 31**.

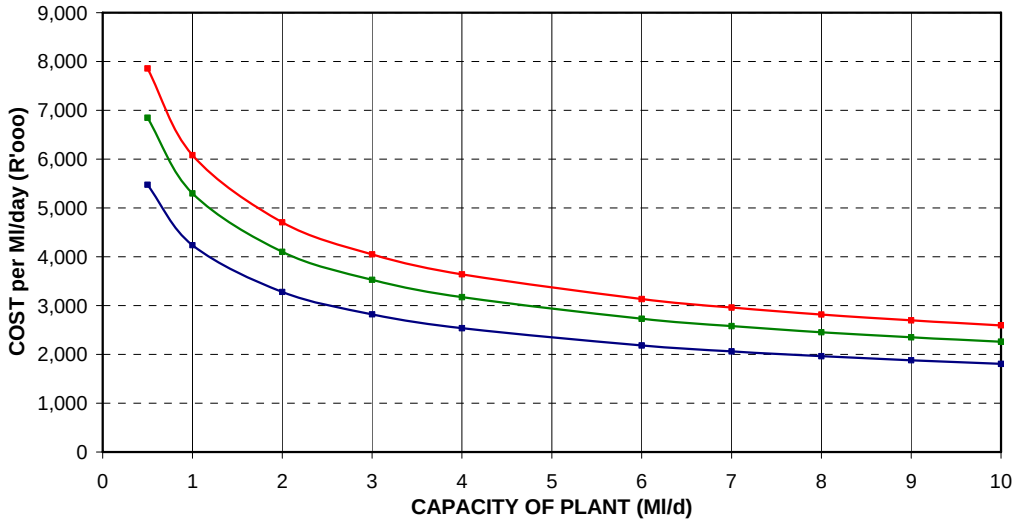


Figure 31 : Capital Investment Cost Curves for Integrated Ponds Treatment Plants

3.2 Indicative operations and maintenance cost

The operations and maintenance cost for a wastewater treatment plant would include the following components:

- Personnel and labour
- Electrical power consumption
- Chemical dosing
- Maintenance and repair
- General expenses
- Laboratory, monitoring and surveillance

The personnel and labour cost would be sensitive to the type of installed treatment technology, complexity of the treatment process and to the size of the facility. A BNR activated sludge plant would require more skilled and experienced plant management and process control compared to an integrated pond system.

Electrical power consumption cost would depend on the number of size of mechanical equipment items with associated electrical drive motors which are installed at a plant. The plant site topography, for example, will influence the need for pumping wastewater and the size of the installed pumps. The treatment technology will determine whether natural aeration (such as in a trickling filter) or mechanical aeration (such as in an activated sludge reactor) is used. The wastewater composition, specifically the COD and TKN concentrations determine the size of the aeration devices required.

Chemical dosing in South African wastewater treatment plants is typically restricted to chlorine for disinfection and in some cases ferric chloride or aluminium sulphate for chemical phosphate removal. In a limited number of treatment plants lime is dosed to supplement alkalinity. The chemical treatment cost is sensitive to the treatment plant flow rate, since chemical dosages are typically flow paced.

Repair and maintenance costs of mechanical/electrical equipment are sensitive to the installed treatment technology. Industry standards have been developed to estimate an appropriate annual allowance for preventative maintenance, equipment care and repair to achieve a high level of equipment reliability and operability:

- Civil structures = 0.25 % of constructed cost
- Buildings = 1.5 % of constructed cost
- Pipelines = 0.75 % of constructed cost
- Mechanical equipment = 5.00 % of constructed cost
- Electrical equipment = 3.00 % of constructed cost
- Instrumentation = 5.00 % of constructed cost

The operation and maintenance of a wastewater treatment facility requires a number of general costs including insurance, security, site maintenance, transport etc.

Sampling and monitoring of a number of wastewater, sludge and environmental variables are required. The monitoring requirements are dictated by licences/permits, the need to have information to optimise plant operations and even the Records of Decision issued in terms of the EIA prepared for the wastewater treatment plant construction.

The unit operating and maintenance cost (R/m^3) for a treatment plant also depends on the size of the treatment plant and the utilisation level (actual wastewater flow versus plant design treatment capacity) of the facility. Certain O&M costs, such as personnel and labour are relatively fixed and not dependent on the actual wastewater flow received at the plant. Other O&M costs, such as chemical dosing and electrical power consumption are variable and sensitive to the actual wastewater flow received at the plant.

The indicative O&M costs were developed for a range of wastewater treatment plant sizes and for the following treatment technologies:

- Integrated pond with polishing wetlands
- Trickling filtration (biofilter) plants
- Activated sludge plants

The indicative operation and maintenance (O&M) cost for the different generic wastewater treatment technologies are illustrated graphically in **Figure 32**, **Figure 33** and **Figure 34.** The indicative O&M cost curves reflect a range of 50 %, 75 % and 100% utilization of the installed treatment plant capacity.

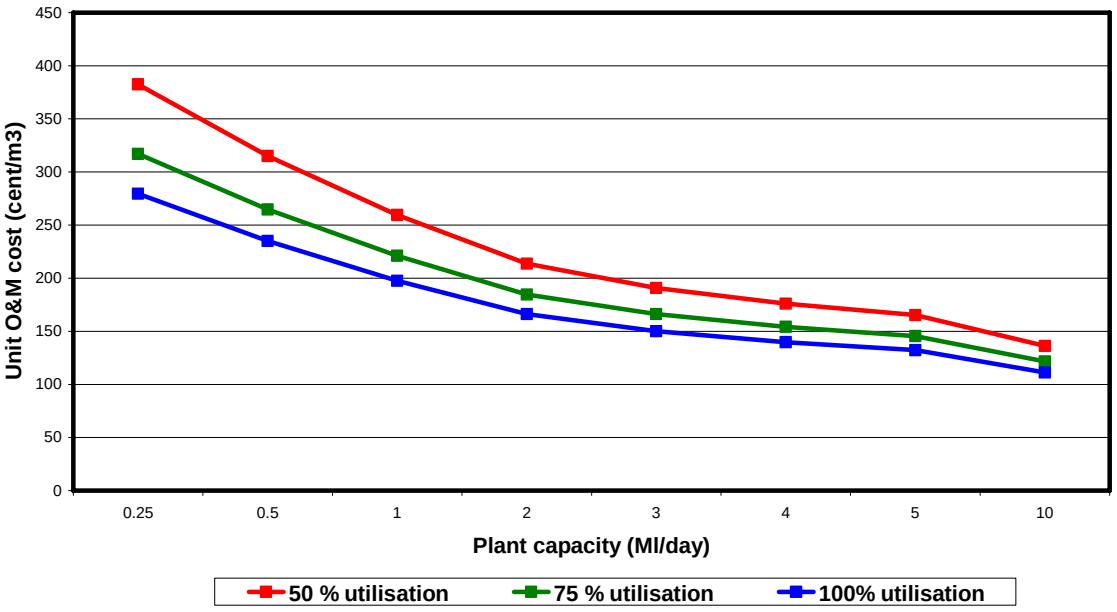


Figure 32 : Indicative O&M costs for Activated Sludge Plants

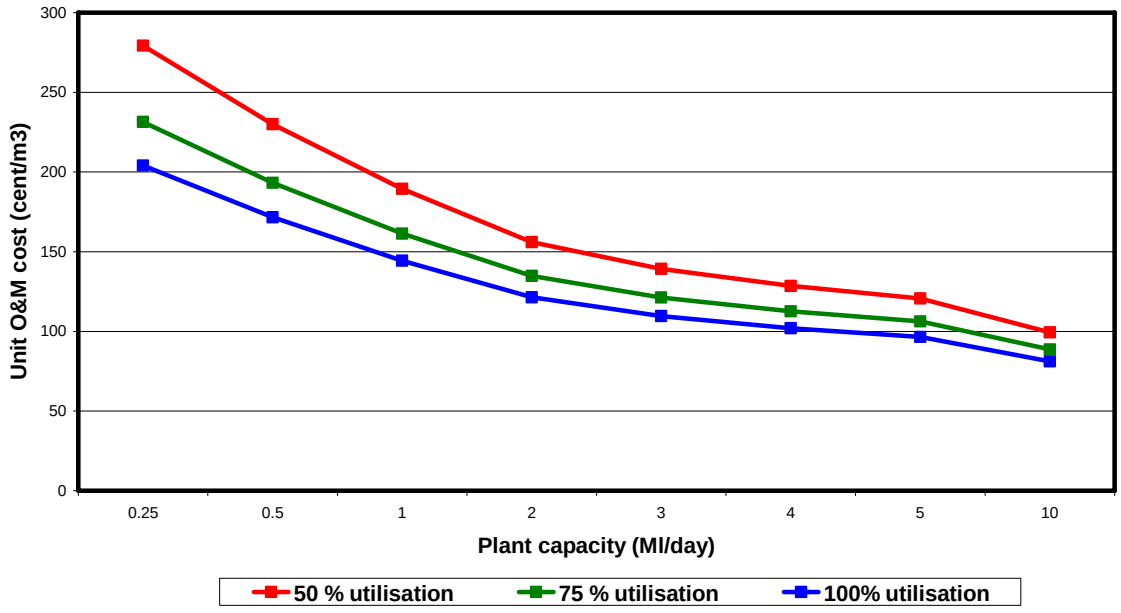


Figure 33 : Indicative O&M costs for Trickling Filter Plants

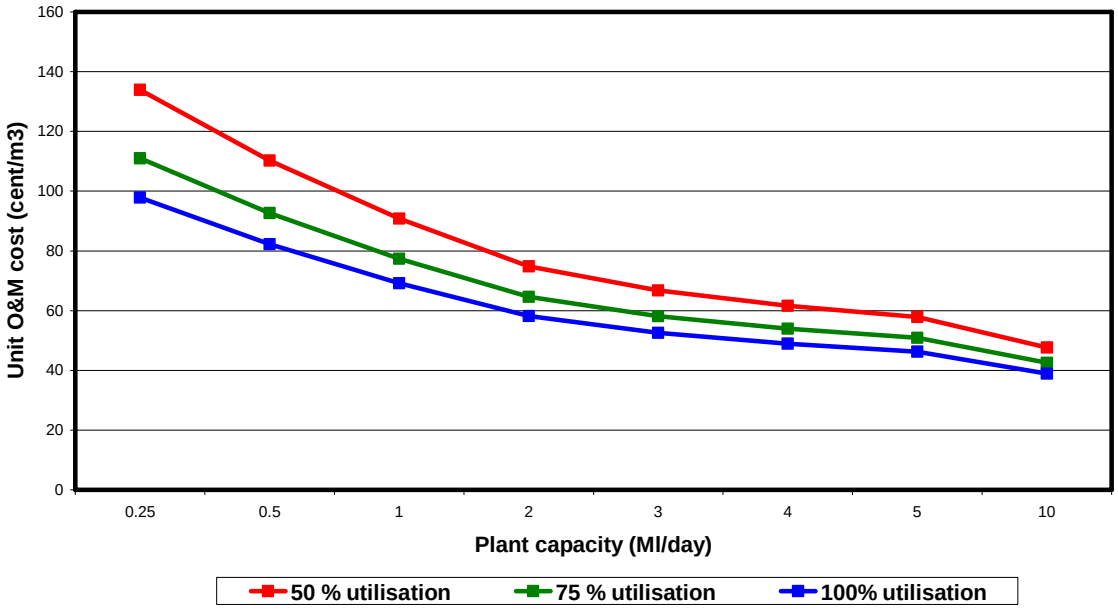


Figure 34 : Indicative O&M costs for Integrated Ponds and Polishing Wetlands