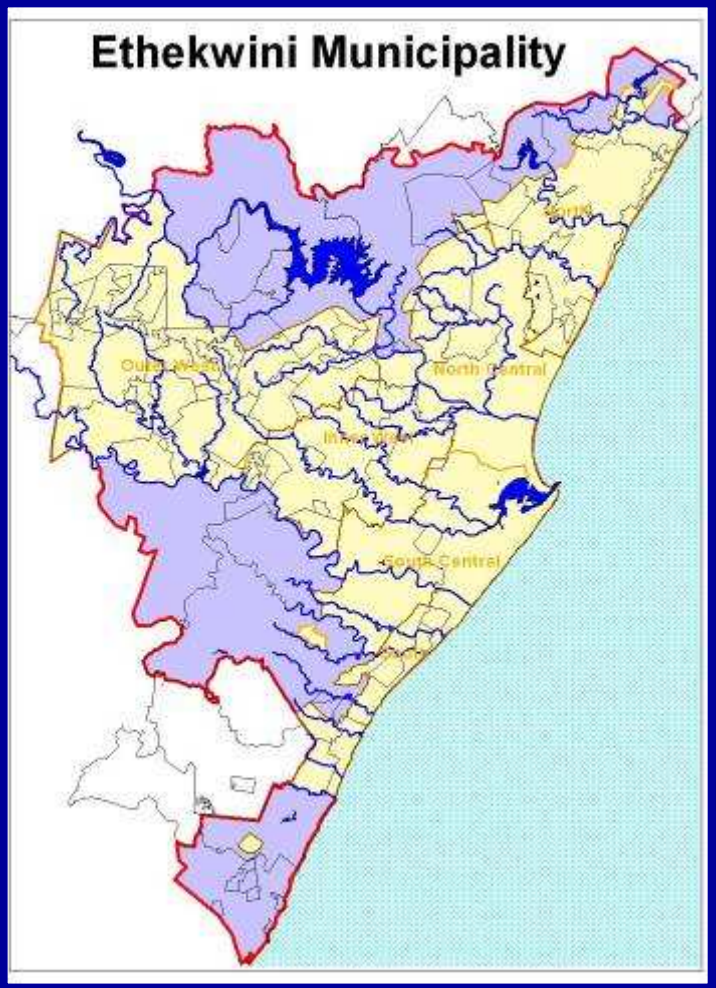
Sustainable Sanitation in the eThekwini Municipality

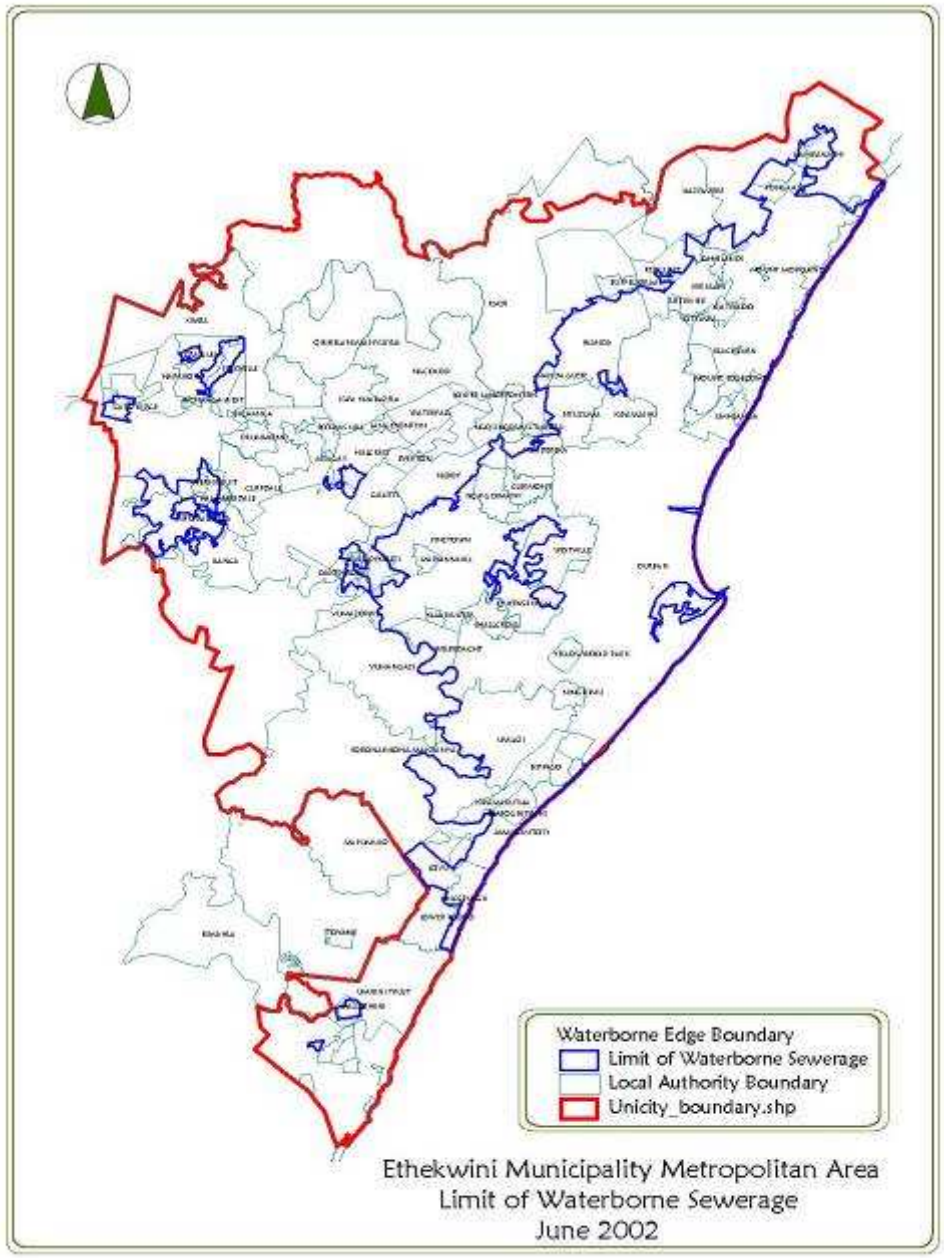
Prepared by : T Gounden

August 2008

Ethekwini Municipality



- Old Metro Boundary 1366 km^2
- 2.5 Million Population
- Unicity 2297km^2
- 3.5 Million Population



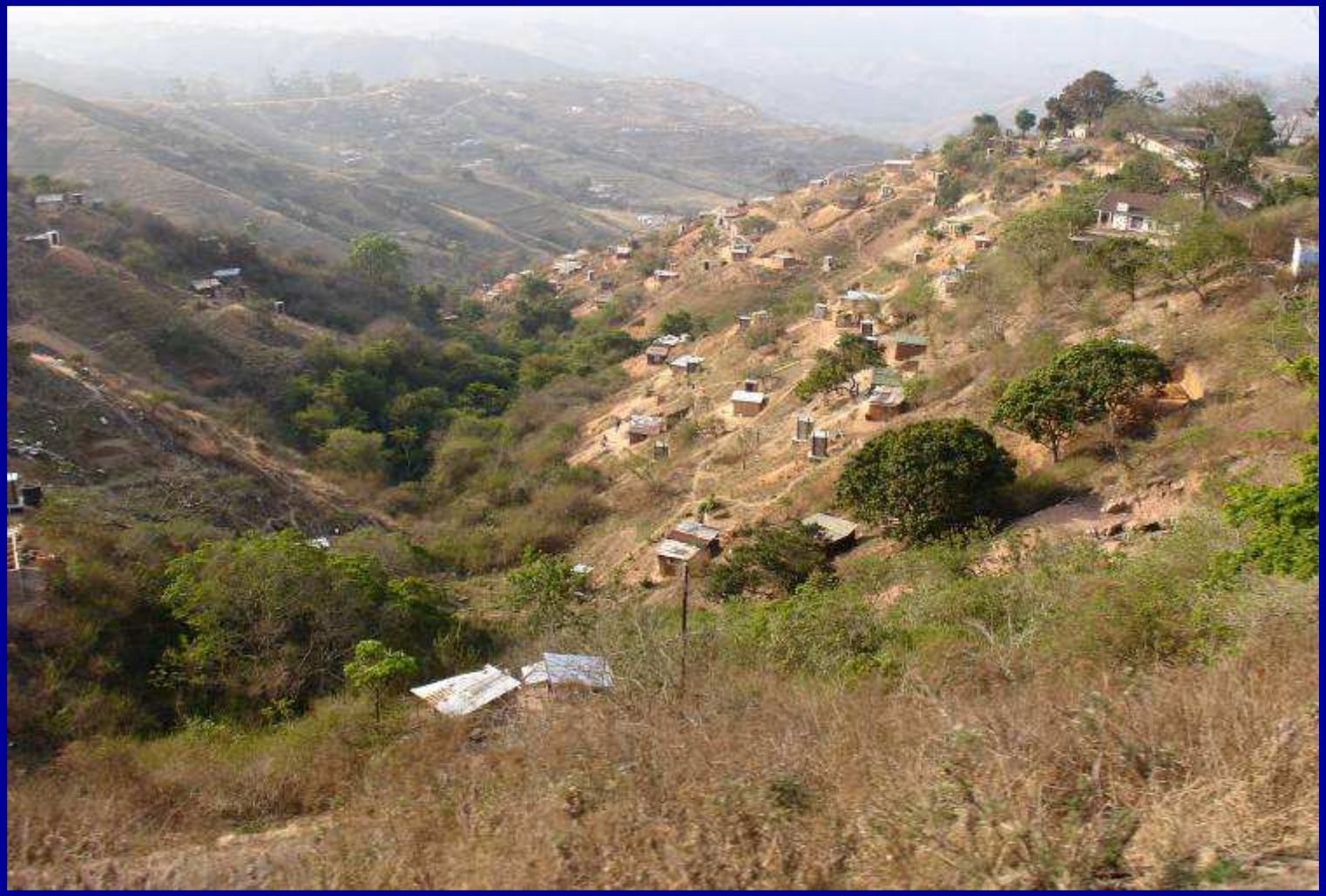
Waterborne "Edge"

Current Sanitation Services

- Urban
  - 420 000 waterborne
  - 30 000 septic tanks / conservancy tanks
- Rural
  - 60 000 UD
  - 26 000 backlog
- Urban / Peri Urban
  - Ablution blocks – 39 in informal settlements
  - Backlog – 240 000 households
  - VIPs 60 000 to be emptied

Rural / Peri Urban UD Toilets

- Key initiative for rural areas



Factors Influencing Choice

Financial

- Waterborne sewerage is extremely costly due to topographical conditions in unserviced rural areas
- Cost of emptying conventional VIPs unsustainable

Factors Influencing Choice

Technical / Physical

- Tankers cannot reach many pits due to terrain and densities
- Desludging by tankers problematic due to solid matter in pits
- Manual emptying is also problematic due to terrain and costs

Factors Influencing Choice

- Water and Sanitation delivered as a package, cost effective education delivery
- Each household receives 300 litres of water a day – dictates use of dry sanitation
- Safe on-site disposal of human waste
- No new pits required to be excavated when full
- No need to move top structure when full

Factors Influencing Choice

Environmental / Health

- Waste decomposes before expose to surrounding soil
- Decomposed contents is safer to handle when removing
- Conventional VIP - seepage of raw sewage into surrounding soil/water table
- Manual emptying of VIP poses health risks

ETHEKWINI MUNICIPALITY

Pedestal with urine diverting fitting

Urine Diversion Toilet

Urinal for men

Bucket containing sand & ash

Pedestal with urine diversion fitting

Cover over second vault

Vent-pipe with fly- screen

Double vault above-ground

Sliding cover access to vault

Project Implementation Approach

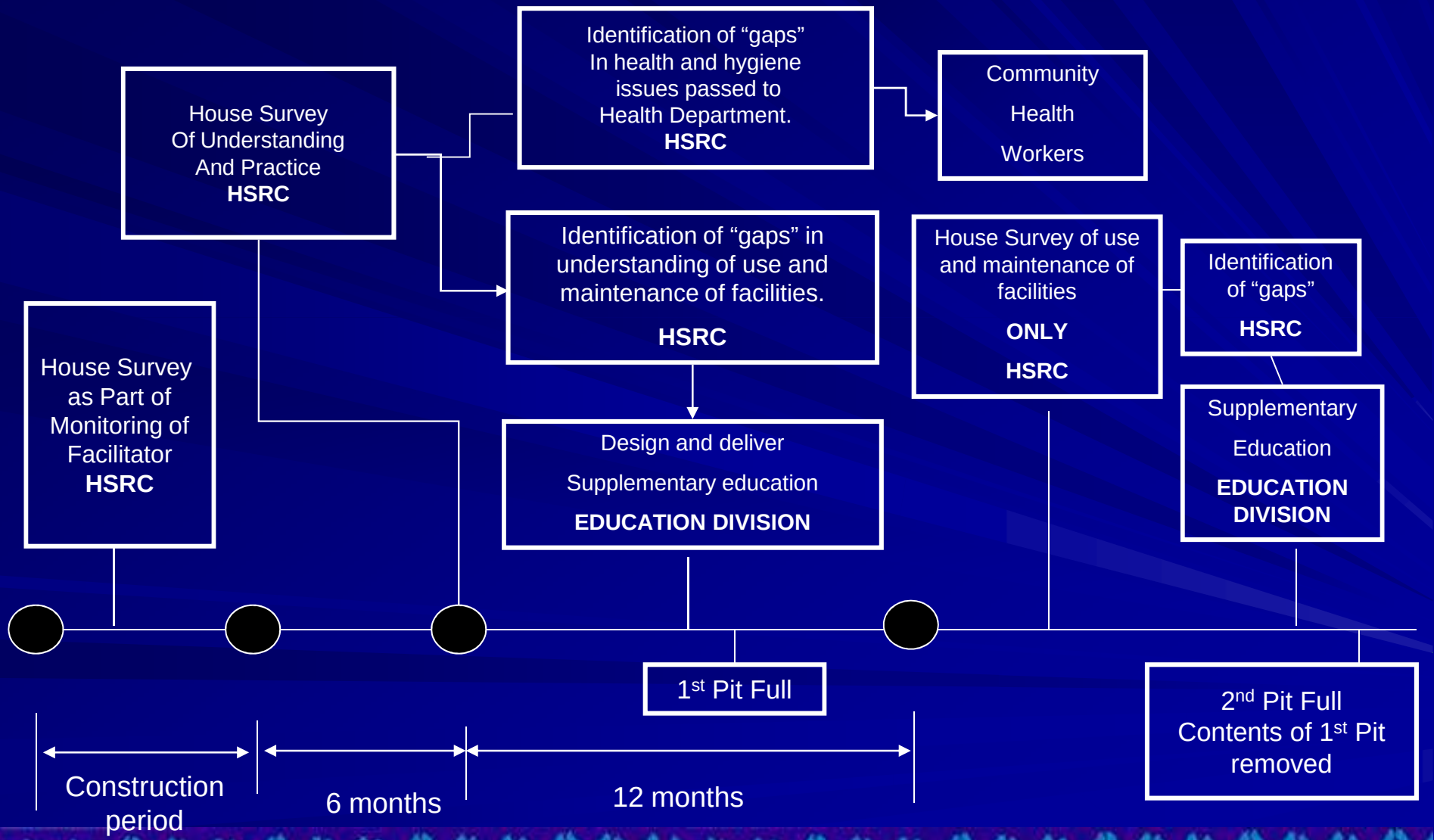
- Project Management Construction Division (EWS)
- Community Participation through elected Project Steering Committees
- Education Training and Capacity Building - ISD Consultants used to train facilitators from the communities
- Focus on women essential to success of the programme
- Labour intensive methodologies
- Employment Policy – local labour on a task basis

Project Implementation Components

- Series of structured household visits (5 visits)
- Facilitators trained by ISD Consultant
- Education Material Development

Monitoring of Household Understanding & Practice of:

- Health and Hygiene
- Water and Sanitation System

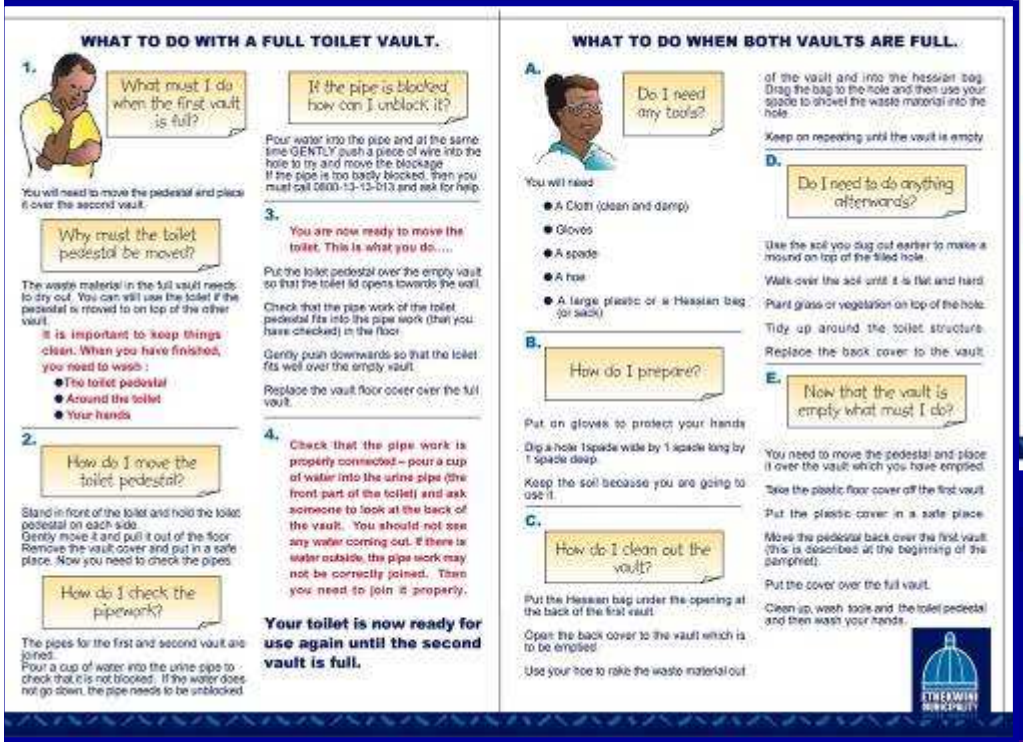


Home Visits by Local Facilitators

- Visit 1 - Brief homeowner on Project
  - Data gathering Baseline Survey
- Visit 2 - Health and Hygiene
- Visit 3 - How UD Toilets work
- Visit 4 - Water System
  - How much costs
  - Supply of System
- Visit 5 - O & M of the toilet
  - How to empty toilet

Educational Materials

- Leaflet showing step by step method of emptying



WHAT TO DO WITH A FULL TOILET VAULT.

1. What must I do when the first vault is full?

You will need to move the pedestal and place it over the second vault.

Why must the toilet pedestal be moved?

The waste material in the full vault needs to dry out. You can still use the toilet if the pedestal is moved to on top of the other vault.

It is important to keep things clean. When you have finished, you need to wash :

- The toilet pedestal
- Around the toilet
- Your hands

2. How do I move the toilet pedestal?

Stand in front of the toilet and hold the toilet pedestal on each side.
Gently move it and pull it out of the floor.
Remove the vault cover and put in a safe place. Now you need to check the pipes.

How do I check the pipework?

The pipes for the first and second vault are joined.
Pour a cup of water into the urine pipe to check that it is not blocked. If the water does not go down, the pipe needs to be unblocked.

If the pipe is blocked how can I unblock it?

Pour water into the pipe and at the same time GENTLY push a piece of wire into the hole to try and move the blockage.
If the pipe is too badly blocked, then you must call 0800-13-13-013 and ask for help.

3. You are now ready to move the toilet. This is what you do.....

Put the toilet pedestal over the empty vault so that the toilet lid opens towards the wall.

Check that the pipe work of the toilet pedestal fits into the pipe work (that you have checked) in the floor.

Gently push downwards so that the toilet fits well over the empty vault.

Replace the vault floor cover over the full vault.

4. Check that the pipe work is properly connected – pour a cup of water into the urine pipe (the front part of the toilet) and ask someone to look at the back of the vault. You should not see any water coming out. If there is water outside, the pipe work may not be correctly joined. Then you need to join it properly.

Your toilet is now ready for use again until the second vault is full.

WHAT TO DO WHEN BOTH VAULTS ARE FULL.

A. Do I need any tools?

You will need

- A Cloth (clean and damp)
- Gloves
- A spade
- A hoe
- A large plastic or a Hessian bag (or sack)

B. How do I prepare?

Put on gloves to protect your hands.

Dig a hole 1spade wide by 1 spade long by 1 spade deep.

Keep the soil because you are going to use it.

C. How do I clean out the vault?

Put the Hessian bag under the opening at the back of the first vault.

Open the back cover to the vault which is to be emptied.

Use your hoe to rake the waste material out of the vault and into the hessian bag. Drag the bag to the hole and then use your spade to shovel the waste material into the hole.

Keep on repeating until the vault is empty.

D. Do I need to do anything afterwards?

Use the soil you dug out earlier to make a mound on top of the filled hole.

Walk over the soil until it is flat and hard.

Plant grass or vegetation on top of the hole.

Tidy up around the toilet structure.

Replace the back cover to the vault.

E. Now that the vault is empty what must I do?

You need to move the pedestal and place it over the vault which you have emptied.

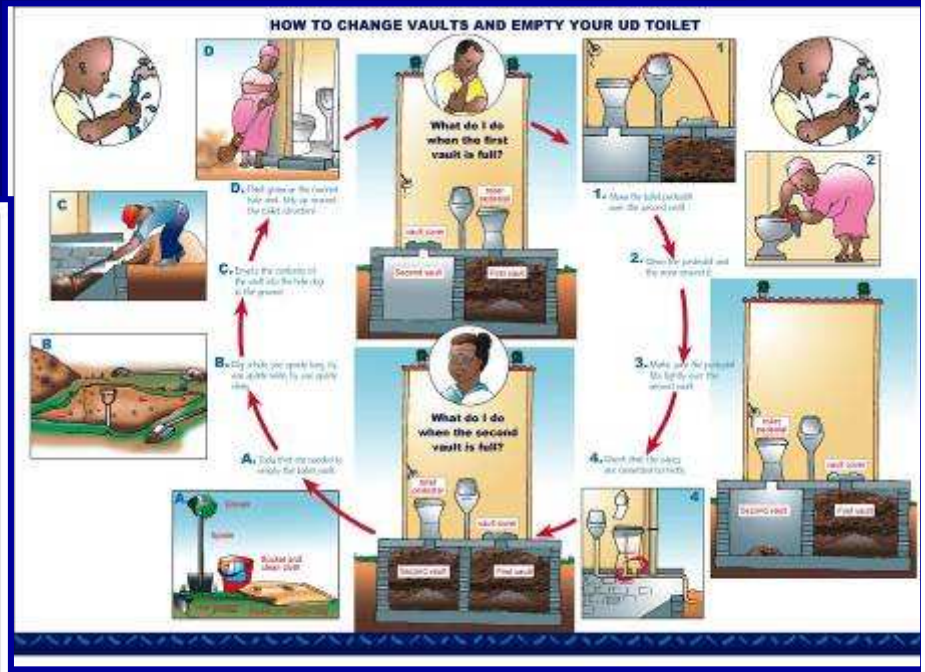
Take the plastic floor cover off the first vault.

Put the plastic cover in a safe place.

Move the pedestal back over the first vault (this is described at the beginning of the pamphlet).

Put the cover over the full vault.

Clean up, wash tools and the toilet pedestal and then wash your hands.



Street Theatre

- Education follow-up phase
  - Street theatre focusing on the emptying procedure and health and hygiene education

Response to Operation and Maintenance

- Developing a caretaker approach to water and sanitation management
  - One caretaker to manage 300 households
  - Education of households (health, operations and maintenance)
  - Promote services of SSIP
  - Provide advice when emptying
  - Extension of monitoring (O & M Ownership)
  - Report to EWS

Development of Small Scale Independent Contractors

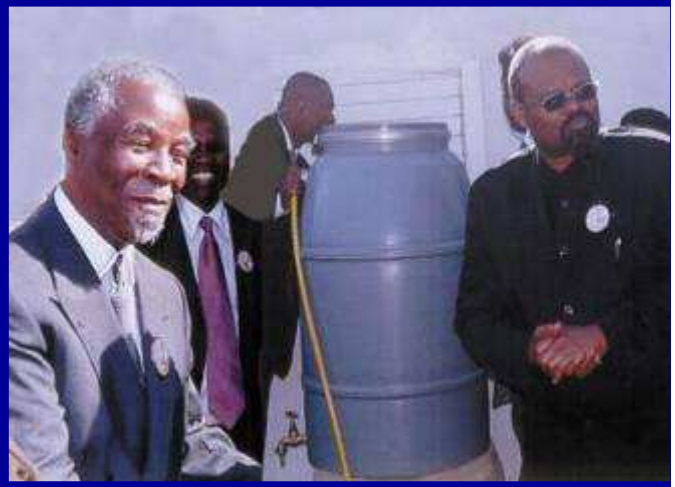
- To provide emptying service
- Set up general hardware supply store
- Provision of general operation and maintenance services

Lessons Learned

- Centralization of the programme has allowed for:
  - Cost savings
  - Focus on quality (sustainability)
- The implementation model must suite the needs of institution and be acceptable to community
- Ongoing independent monitoring allows for rapid response
  - Securing of back panels
  - Adequate cover for vent pipes
  - Pedestals design for children

Lessons Learned

- Many households are emptying vaults
- Surveys show 28% refuse to empty but are prepared to pay
- Visit of President and Minister of Water Affairs greatly increased acceptance

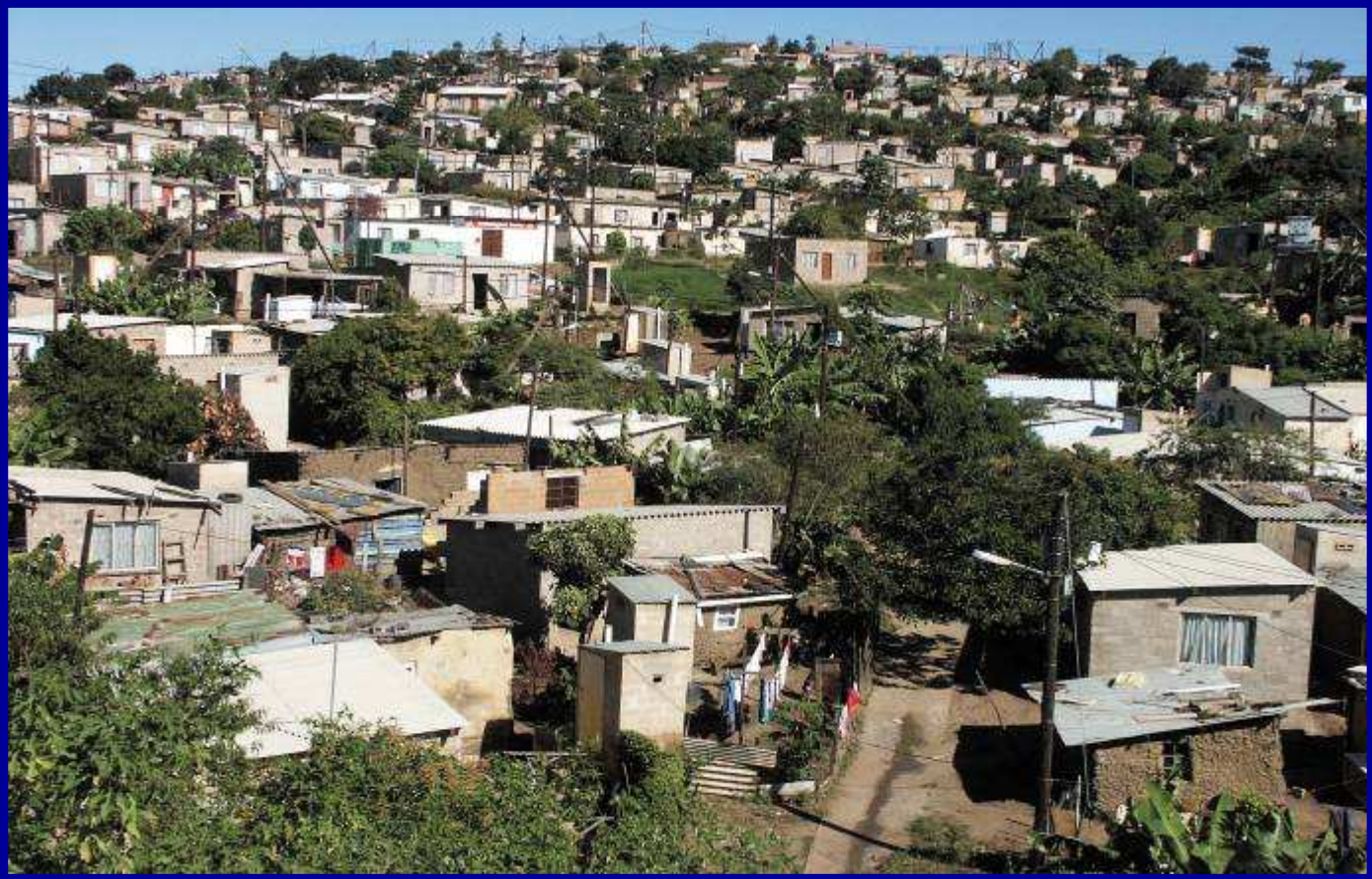


Lessons Learned

- Ongoing monitoring and evaluation essential
- Enables early detection of problems – technical and social. e.g.
  - Back covers
  - Toilet seats for children
  - Acceptance issues in some areas
- Education and implementation can be amended accordingly
- Need to stress
  - Primary focus for sanitation is improving health
  - Secondary focus job creation

Urban - Informal Ablution Blocks

- Key initiative for Dense Informal Settlements
- Initiated in 2007



Why this technology

- MDG – Targets
- Reduce disease
- Temporary solution for areas to be developed (10 – 15 year plan to reduce housing backlog)
- No space to put in other sanitation technology
- Supports goals of Health Department



Selection of Levels of Service

- Based on:
  - Topography
  - Access to sewer system
  - Land availability
  - Water tables.

Sanitation Types

- Constructed Ablution Blocks (ABs)
- Constructed Urine Diversion toilets
  - (UDs)
- Container ABs
- Share Blocks (no local sewer)

Implementation Steps

- Community and Councillor consultation
- Social Research – health conditions, population density, community structures
- Technical research – topography, sewer access, land ownership, geotech, etc.
- Construction
- Operation and Maintenance (O&M)

Design / Model

- Basic Access to sanitation
- One block per approximately 100 units
- Walking distance to block (150-200m)
- Shower/separate toilets for male and female
- Storeroom
- Washing facility

Management of Ablution Blocks

- Environmental Health Officers - Facilitation and monitoring
- Environmental Health - Supply of materials (toilet paper, mops, refuse bins, etc.)
- Caretaker appointed and paid for by local community

Lessons Learned

- Some facilities well maintained – others are not
- Where caretakers are appointed – clear improvement in conditions
- Lighting helps to provide safe environment at night for women and children
- Washing facilities reduces greywater accumulation

Urban / Peri-Urban Pit Emptying

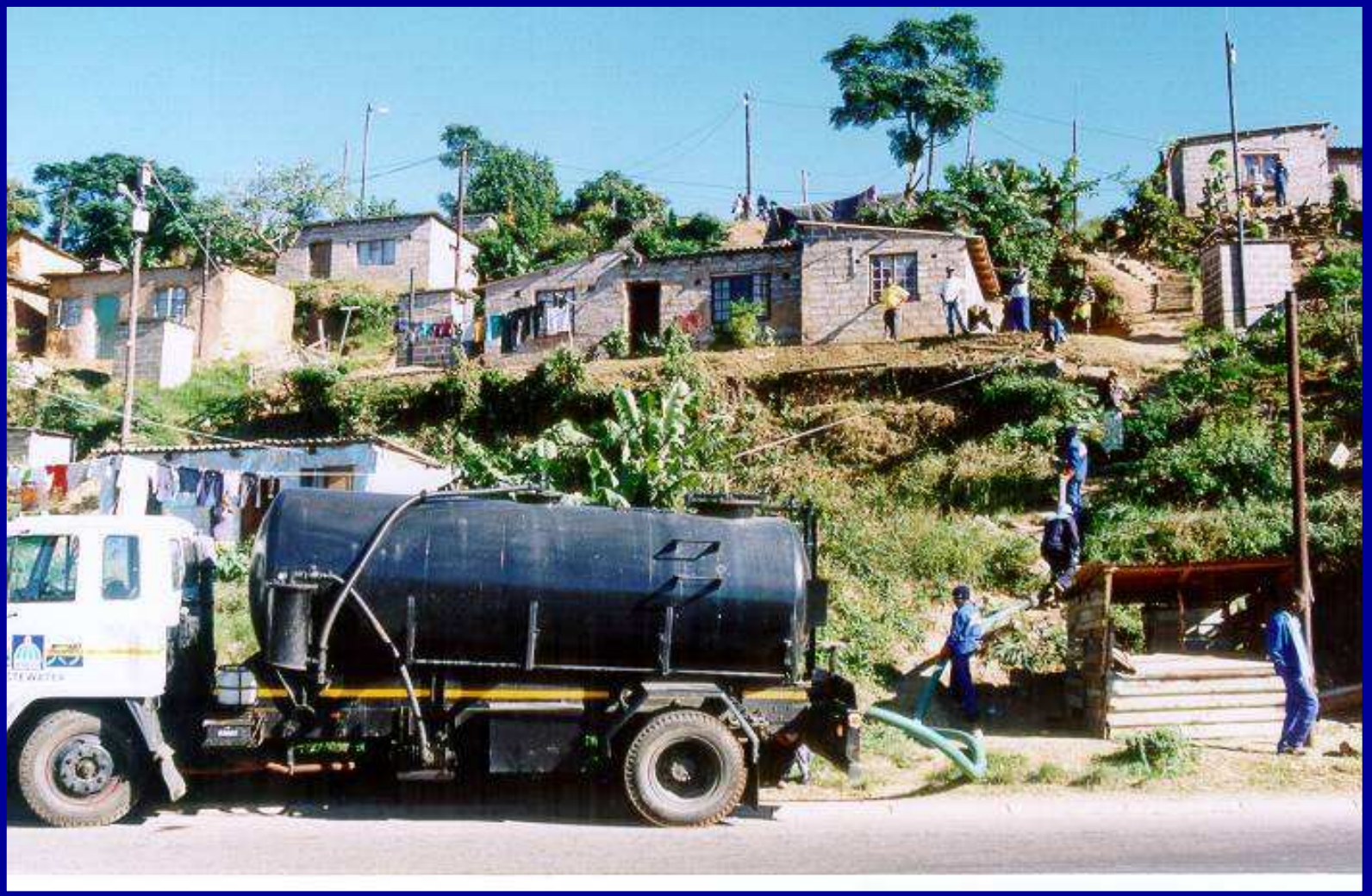
- During 80's and 90's VIPs were the basic level provided
- They are now full and need to be emptied
- Lack of space (density of settlements) does not allow for relocation
- Free basic sanitation service – 1 pit emptying every 5 years

Emptying Challenges

- Many pits unlined and toilets subject to catastrophic collapse.
- Pits constructed in inaccessible locations.
- Pit contents not homogeneous.
- Highly variable pit sizes.
- High cost of emptying using mechanical desludging

Challenges (cont.)

- Access to properties



Emptying the 60 000 Existing Pits

- The high cost (over R1800 per pit) of emptying single pit toilets individually, made this approach uneconomic – given the cost of constructing new single VIP type toilets (approx. R3000).
- A research project was initiated to determine how best to empty these toilets.
- A solution that maximised job creation was favoured.

Emptying Pits (cont.)

- Mechanised solutions proved to be limited in their application and efficiency.
- Disposal of the pit contents required prior separation of the sewage from the solid waste (rags, plastic, etc).

Pilot Project

Option 1 – Waste to Hopper and Trunk main

- Manual excavation
- Transport to the nearest vehicular access using modified trolleys to carry 100 litre drums containing excavated pit contents.
- Transport by vehicle to a local processing site.
- Processing using a specially modified hopper, connected to a sewer (trunk main)

Option 1 – Hopper/Trunk main

Challenges With Methodology (Hopper/Trunk main)

- Additional solid loads on small treatment works
- Washout of nitrifying micro organisms

Option 2 – Burial of waste on site

- Option used if land available on site
- Reduces pressure on trunk main and treatment works capacity
- Reduces transport and processing costs

Option 2 – Burial on Site

Option 3 – Treatment Works – Drying Beds

- High density areas waste removal to treatment works - Drying beds
- Lime added – transported to landfill
- Use of sludge for growing trees investigated

- Urban Sanitation
- Sewage Disposal
- Education Programme

Urban – Formal
O & M

- Waterborne sewage linked to treatment works
- Problems – abuse and misuse
- High levels of sewage pollution
- High maintenance costs – R6 million per annum

Urban Sanitation

Sewage killed fish, says report

TONY CARNIE

INDEPENDENT scientists have concluded that a sewage leak into the Umbilo/uzana River was the main cause of the recent fish kills in Durban Harbour.

The findings by the Council for Scientific and Industrial Research (CSIR) follow repeated denials by municipal manager Mike Sutcliffe that raw sewage spills were the primary cause of the massive die-off of fish and other marine life just after Christmas Day.

The CSIR report, compiled by researchers Steven Weeris and Shamilla Pillay on behalf of the National Ports Authority, contradicts Sutcliffe's assertion that a combination of rainfall, industrial spillages and other factors played a role in the death of thousands of fish in Durban Harbour from December 26 to December 27.

The city is keeping a tight lid on a second report by scientists Prof Tickey Forbes and Nicolette Demetriades, from the consultancy group Marine and Estuarine Research.

This report, expected to corroborate the CSIR findings, was handed to the city last month, but deputy health head Siva Chetty has refused to release it to The Mercury, despite repeated requests.

Chetty was appointed by Sutcliffe to deal with all media queries on the fish kill, and his refusal to release the report has fuelled suspicions of a city hall cover-up or a reluctance to acknowledge sewage management problems.

The CSIR scientists do not pinpoint the source of the sewage spillage, but state that a significant volume of sewage was reported lost from the Queensburgh sewage works in December, and that the decomposition of sewage led to severe deoxygenation of the water and the inability of fish to breathe.

They also did water toxicity tests at several points in the harbour and the highest toxicity readings were found at the mouth of the Umbilo/uzana River, which empties into the harbour.

"Therefore, the discharge of sewage into the bay is highly likely to have been the primary cause of the fish kill event in late December," they reported.

There were, in fact, two fish kills in the harbour in December. The CSIR team said the first event, which began on December 21, was most likely owing to an accidental or illegal discharge of effluent into the Lavender Creek stormwater drains near Wilson's Wharf.

NOW READ
CITY SUES OVER BLOCKED SEWER
PAGE 3

The CSIR team did not collect water samples for analysis during the first fish kill, and were unable to say whether the effluent leaking into the wharf area was toxic.

However, with the second mass seizure and widespread fish kill, they ruled out the possibility that heavy rainfall had flushed a variety of pollutants into the bay since no significant rain was recorded for two weeks before.

They noted that there was also a "known spill of waste wash water from the Indra Brewery and a possible overflow from the Hullett (Sugar) wastewater dam" but they had since ruled out these sources as a possible primary cause.

They also ruled out a third possibility of a widespread algal bloom deoxygenating the harbour water.

"It is concluded that this kill was a result of the sewage discharge into the Umbilo/uzana River that eventually flowed into the harbour," he said.

Sutcliffe, however, denied there was an attempt to suppress information.

"There is certainly no cover-up. All of these reports will get into the public domain."

The city's approach was to gather all the available evidence about the fish kill and waste management problems in the city from independent scientists and the city's own experts and officials.

Once all this evidence was consolidated, it would be analysed and interpreted so that the city could draw up a set of recommendations to deal with problem areas.

"So I am not going to respond to each report which comes out, in a reactive fashion. Otherwise it becomes a situation of "another report - another comment".

"We would rather sit down and reach conclusions after analysis, and we will ask ourselves whether there are certain things which we can do better."

Sutcliffe remarked that although he had not seen the CSIR report yet, he would be surprised to hear emphatic suggestions about a single cause.

In the meanwhile, Durban water and waste department head Neil Macleod has sent The Mercury a detailed response to a series of recent articles on the health status of Durban's major rivers.

While he disputed the accuracy of some aspects of the reports, Macleod acknowledged that river pollution problems "undeniably exist" and he welcomed the role of the media in drawing attention to these issues. His responses will be published later this week.

THE MERCURY MONDAY 15 FEBRUARY 2006

THE MERCURY THURSDAY DECEMBER 27 2007

Anger as more fish die in harbour

MATTHEW SAVIDES

DURBAN residents were furious yesterday after dozens of fish washed up at the Bluff Yacht Club, apparently because of pollution in the water.

Local authorities said the substance was probably hydrogen sulphide, which is toxic to humans and animals.

eThekwini Municipality officials were in the area at about 8pm, taking water samples and assessing the situation while Water Affairs Department officials were on standby.

When *The Mercury* visited the club yesterday evening, some of the fish on the slipways were bleeding, and others had abnormal growths.

A nauseating, sulphur-like smell was apparent from several kilometres away from the yacht club.

Resident Koos Coetzer said this was the worst pollution he had seen in the area. Pollution had previously been confined to the lower regions of the port.

"Yesterday (on Tuesday) the water was clear, but this morning (yesterday) it was much darker. The water got darker and the smell stronger as the morning progressed. Fish started gathering on the water's edge. You could see they were struggling to breathe," he said.

Several fish were flopping around on each of the three slipways, angering the small crowd which gathered. Water Affairs Department Deputy Director Lin Grassdet-Blondin said yesterday's incident was linked to two others since last Friday that had left thousands of fish dead.

On Friday and Monday fish were found dead at Wilson's Wharf. Although water sample results did not reveal exactly what had caused the deaths, Grassdet-Blondin said hydrogen sulphide had played a role.

He received reports yesterday afternoon that about 10 fish were dead, but "a lot were under stress". Water samples were taken and the results were pending, but initial evidence suggested hydrogen sulphide was again the cause of the deaths.

He said such pollution incidents were "fairly common" at this time of year, as many businesses shut down and did not want to spend money correctly disposing of waste.

"Instead, they just dump it. This is not the first time this has happened," he said.

Environmental Affairs Department spokesman Mbulelo Baloyi said the department was aware of the pollution, but would only step in if requested to do so by the eThekwini Municipality, or if it was deemed necessary.

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PICTURE: STEVEN NAIDOO

BLUFF resident Wesley Smith holds up a rock cod, one of several fish which died, apparently from pollution, at the Bluff Yacht Club yesterday

Online friends all the rage

SAN FRANCISCO. Online social networking websites saw their ranks swell and values soar this year as everyone from moody teenagers and mellow music lovers to mate-seeking seniors joined online communities.

Google's freshly released "Zeitgeist 2007" reveals that seven out of the 10 hottest topics that triggered Internet queries during the year involved social networking.

A top ten list compiled by the world's most-used search engine includes British website Bebo, Spanish-language Hi5, and US-based Facebook.

Video-sharing websites YouTube and Dailymotion are on the list, along with the Club Penguin online role playing game for children.

Virtual world Second Life is the final social networking property in the Zeitgeist Top Ten. – *Sapa-AFP*

Problems Facing eThekwini Water Services

Historical imbalances resulted in communities placing little value on the proper use and maintenance of sewerage systems.

A typical example : Umlazi

- Population 275 000
- Sewers 684 kms
- Blockages 650/month
- Approx. cost R3m p.a.

Abuse and Misuse of Sewerage Systems

Abuse and Misuse Caused by:

- Vandalism
- Lack of knowledge - people throw rubbish into the pipes causing blockages

Abuse and Misuse of Sewerage Systems

- Sewer pipe has been broken to irrigate a vegetable field
- Some people try to illegally connect their toilet pipes into the main systems which results in the pipes being damaged

Launch of Sewage Disposal Education Programme

ETHEKWINI WATER SERVICES launched an EDUCATION and PUBLIC INFORMATION PROGRAMME to inform people that the provision of improved services must be accompanied by CORRESPONDING RESPONSIBILITIES.

Objectives of the Education Programme

- To create a better understanding of the workings of the sewerage system amongst all communities
- Reduce incidence of Sewer Blockages
- Promote understanding of the difference between stormwater and sewerage systems
- Increase awareness of the link between health and good sanitation practices

Initial Education Campaign to Schools and Communities

A perception study was undertaken to investigate people's attitudes, opinions and perceptions by means of a survey questionnaire.

The results of this study were used as a guide to the development of the education programme.

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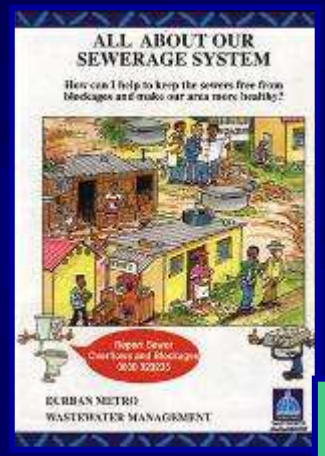
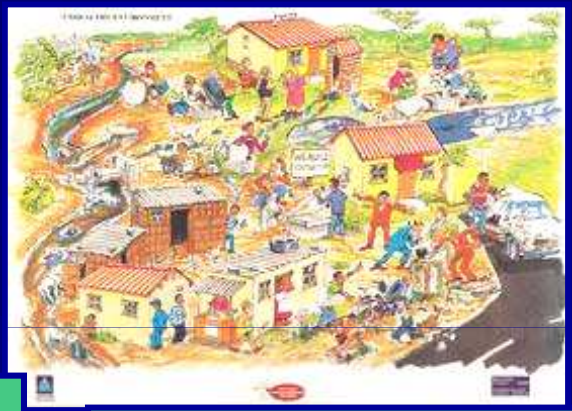
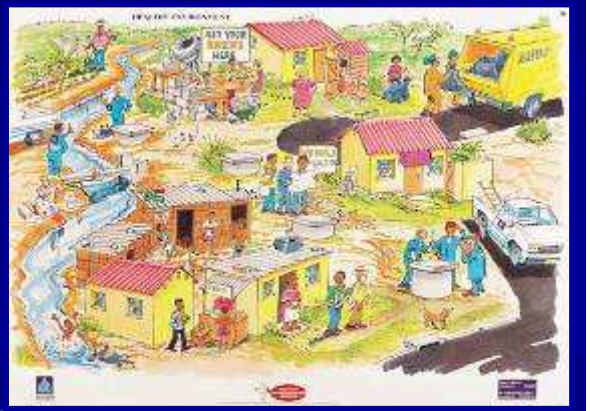
Resource Development

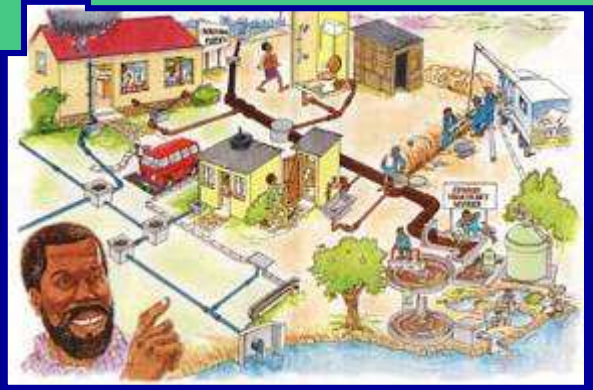


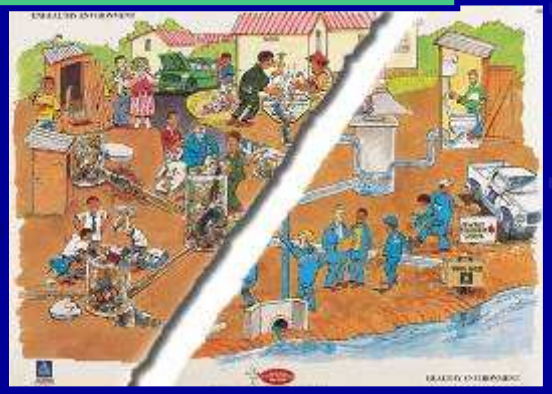
Leaflets distributed to communities





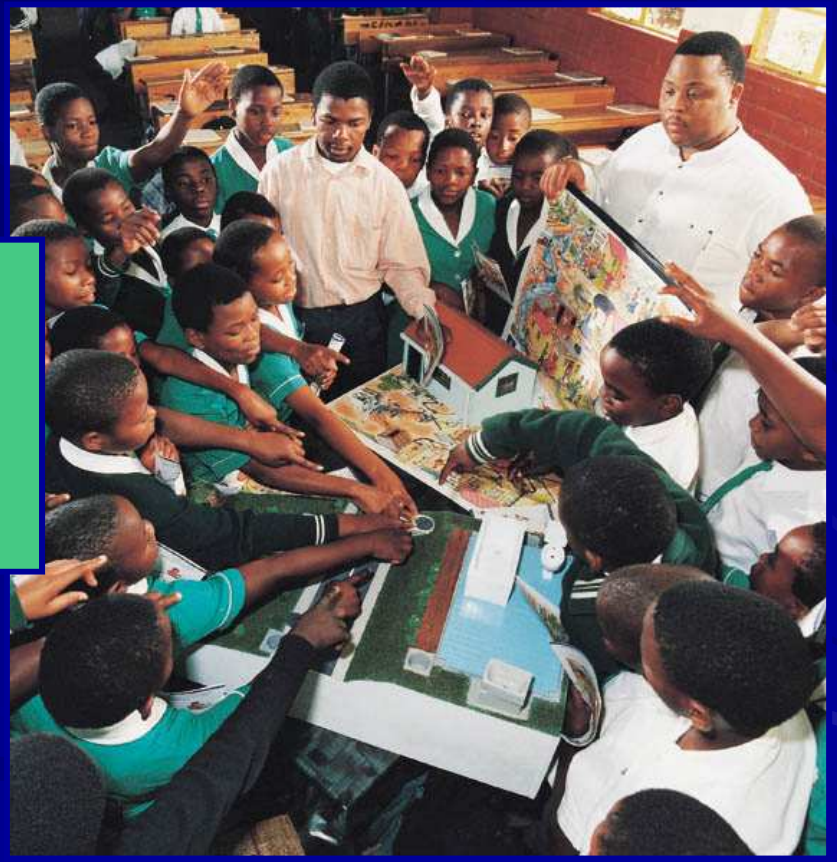
Posters contrasting healthy and unhealthy environments





Resource Development

Working model of sewerage system



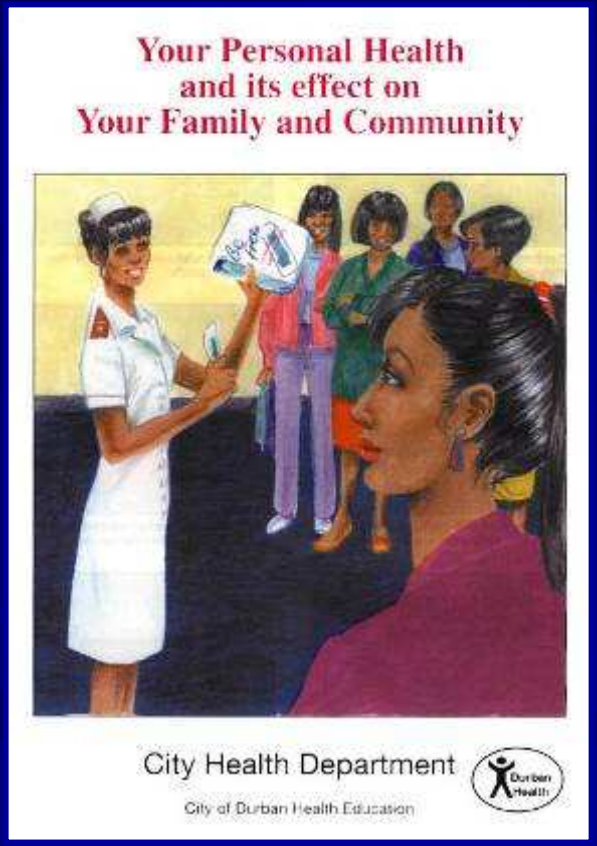
Delivery of Programme

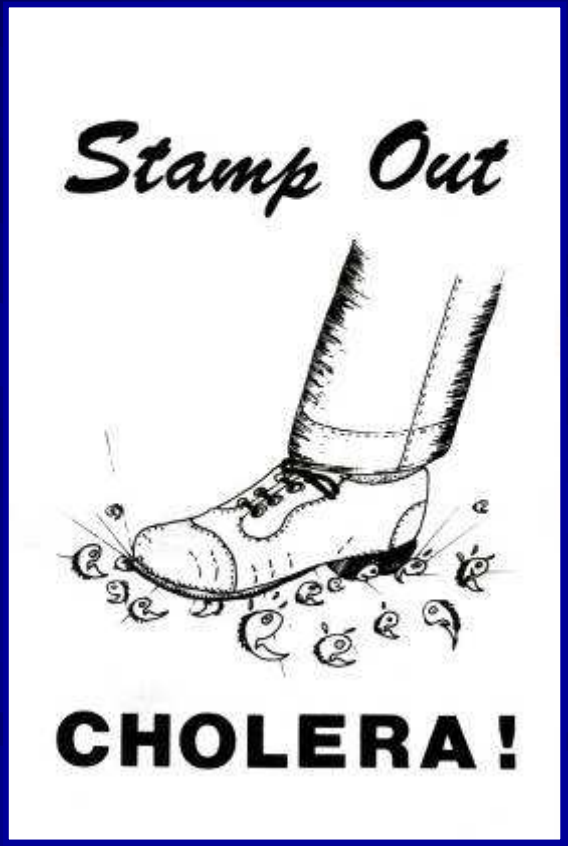
Sewage Education Programme delivered to schools and communities

Delivery of Programme

The programme has further been supported by the Council's Health Department, with visits to schools and communities looking at water and sanitation related diseases.

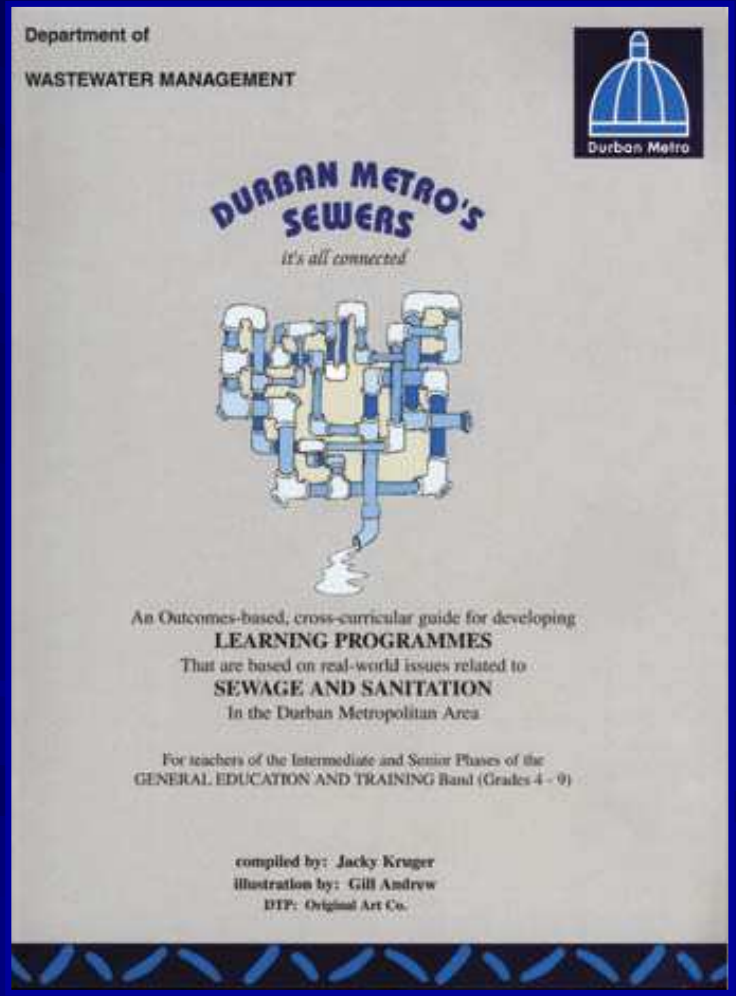
Delivery of Programme





Materials were specifically designed for this phase.

SUSTAINABILITY:
Curriculum Guide



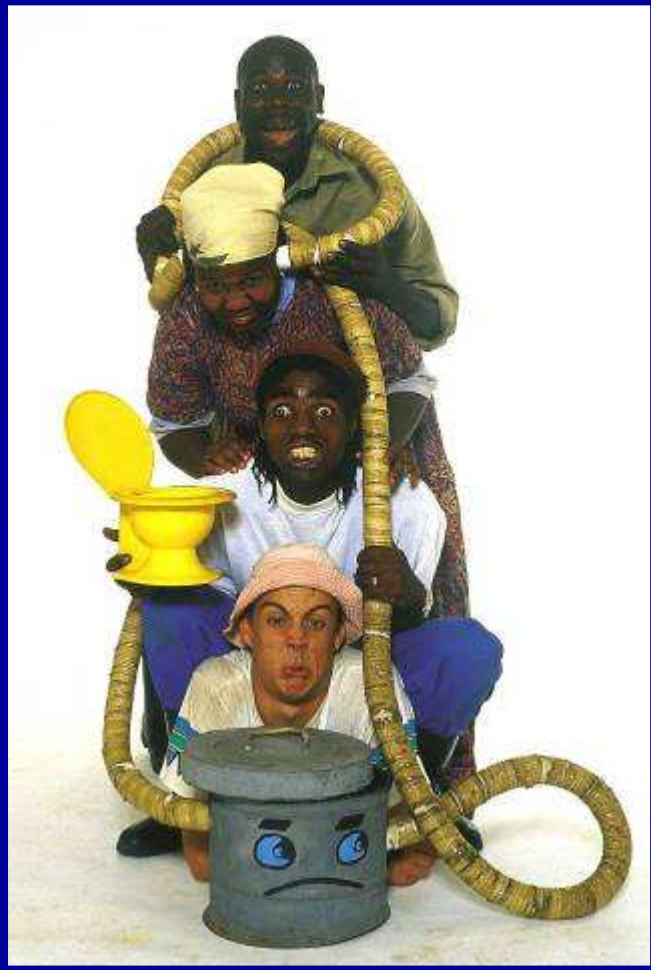
A Curriculum Guide for learners and educators was produced. The central theme of this Guide is water and the disposal of sewage, and is used by educators and learners during “Schools Sanitation Awareness Week”.

SUSTAINABILITY:
Education Awareness Centre

Northern Treatment Works

SUSTAINABILITY:
Street Theatre Performance

A highly interactive drama using humour reaches out to a broad spectrum of users of the sewerage system and particularly serves less literate communities.



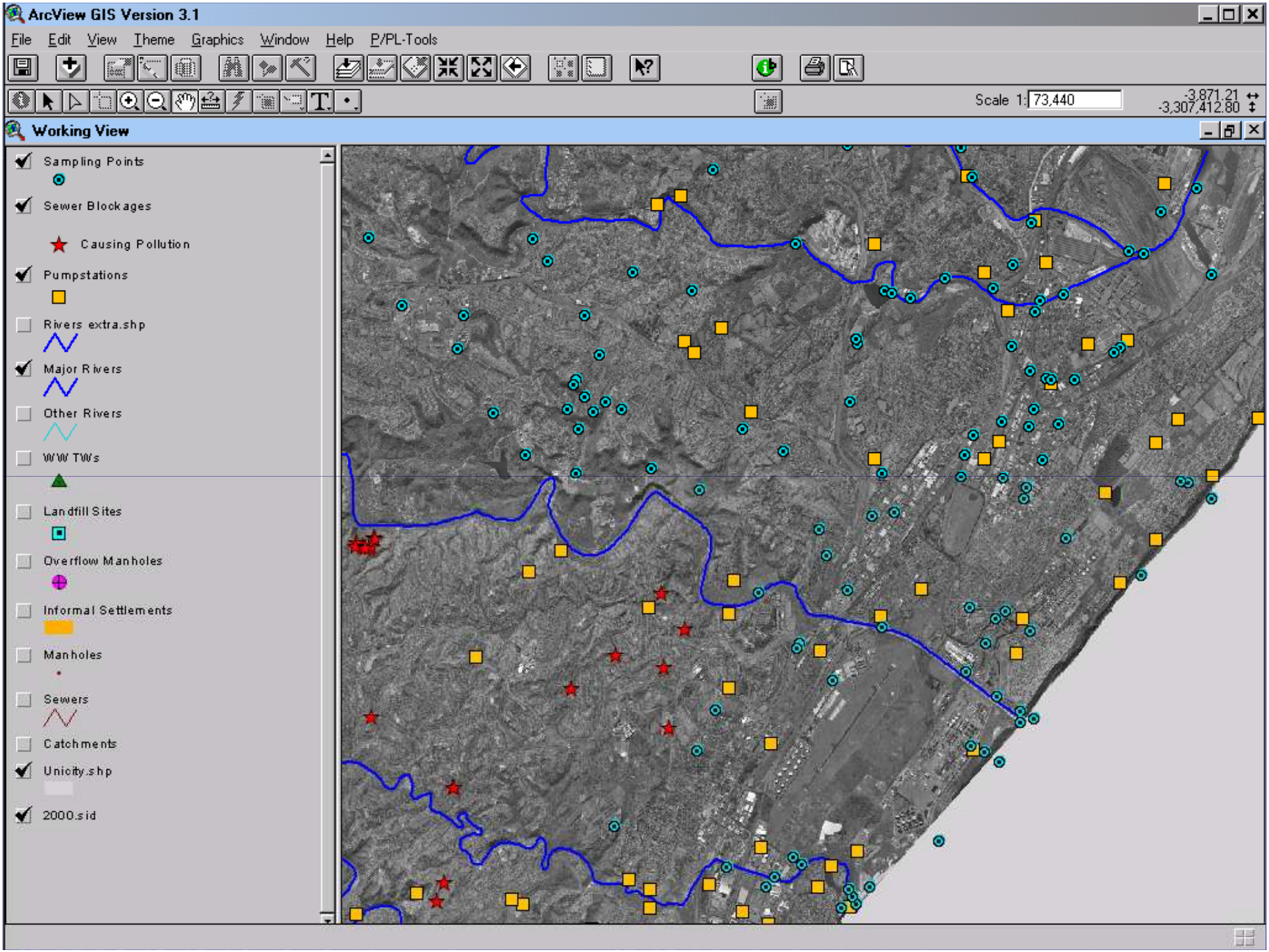
SUSTAINABILITY:
Street Theatre Performance

Within a period of one year

- Approximately 600 performances
- Reaching approximately 38 000 adults
- And 45 000 school children
- Competitions and lucky draws encourage community participation

SUSTAINABILITY:
Use of GIS as an Education Tool

- Problem areas captured on GIS
- Reduces need for a complete educational sweep
- Evaluation of effectiveness of education
- Problem areas targeted for specific interventions
- Pipeline Inspections


ArcView GIS Version 3.1
File Edit View Theme Graphics Window Help P/PL-Tools
Scale 1: 73,440
-3,871.21
-3,307,412.80
Working View
Sampling Points
Sewer Blockages
Causing Pollution
Pumpstations
Rivers extra.shp
Major Rivers
Other Rivers
WW TWs
Landfill Sites
Overflow Manholes
Informal Settlements
Manholes
Sewers
Catchments
Unicity.shp
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SUSTAINABILITY: Call Centre

- Dedicated toll free service number linked to a call centre.
- Main point of contact between department and community.
- Handle complaints regarding blockages and other sewerage related problems.
- Operational 24 hours a day 7 days a week,

SUSTAINABILITY: Tool Kit

- Entire programme developed into toolkit
- Funded by DBSA
- Allows for easy project replication

Flushed with Success

Blockages in the eThekwini Municipality have reduced significantly with savings in excess of R5million

Contributing success factors have been:

- Ongoing Maintenance
- GIS Support
- Call Centre
- Focused Education Interventions

Recognition of Programme Successes

The Sewage Disposal Education Programme has been chosen as a category winner in a prestigious national competition which rewards “initiative and innovation programmes” that uplift the quality of life of the country’s previously disadvantaged citizens.