Focus on Urban & Rural Engineering

NMBM water loss programme

Water supply solutions for Hermanus

CHDM dealing with its rural sanitation backlog
You have real engineering vision.
Now you’re ready for a whole new perspective.


With a career in Project Management at Saudi Aramco, a global leader in the energy industry, your expertise will be a key lynchpin in our operation – and what an operation. Unrivalled in scale, pushing the boundaries of innovation and harnessing world-class technology, we can promise you the exposure you need to excel. We have the model for generations of sustainable energy. But it all begins with a huge investment in your expertise. The limits to what you achieve are up to you. Saudi Aramco offers an excellent compensation and benefits package, as well as an unbeatable lifestyle and a high level of job security.

To find out more and apply, please visit www.symbiosis.co.za or email/fax your CV or SMS your details for a return call. Contact Numbers: (011) 300-2200 / 465-5560 / 083-654-8579 / 083-609-6049 / 082-320-7597 Fax: (011) 465-4318. Email: info@symbiosis.co.za

uncommon opportunities
LIKE MANY OF our readers, I am proudly South African – I acknowledge the struggle and the long road to the freedom and equality we enjoy today.

Whenever I travel internationally, particularly in the US and Europe, I am asked questions about apartheid, and about our inspirational leaders like Nelson Mandela and Desmond Tutu. I was happy to engage with an American couple from Haiti recently, who enquired of me what was I doing and what it was like growing up in the 80s and 90s in South Africa. I shared my own personal experience, and I used words like struggle, revolution, and evolution of a nation. To describe more recent times, however, I used words like development, building, healing, unity, rugby, cricket, diversity, transformation and leadership.

Later, when I reflected on this discussion, I found a measure of reflective depth in these questions, not only for me, but for all the peoples of our country. While the struggle was on and while the revolution was in play: Where were you? What were you doing? What difference did you make? What story do you have to tell? These are sensitive and controversial questions – but indeed very important for introspection for the way forward.

But it is true that South Africa has come a long way since 1994 – a rainbow nation, a new South Africa. And here we are in 2012 – a united nation under the banner of democracy; a land of possibility, sharing, hope and equal opportunity for all.

Where are you? What are you doing? What difference are you making? What stories are you creating?

I am impressed that our government is taking bold steps to focus on infrastructure investment. Have you noticed billboards around the country with images of the State President and infrastructure ministers wearing hard hats and construction clothing, standing in the foreground of construction sites? There are several with President Jacob Zuma, holding a construction drawing, standing on the foreground of a construction site.

At his state of the nation address, President Jacob Zuma said the following: “For the year 2012 and beyond, we invite the nation to join government in a massive infrastructure development drive. We are going to launch a huge campaign of building infrastructure nationwide.”

Jacob Zuma went on to describe the projects, the budgets allocated, and the time frames within which they needed to be achieved. He also said: “Government alone cannot solve these problems, but with all the peoples of South Africa working together, solutions are possible.”

The National Development Plan (NDP) issued by the National Planning Commission, talks about rewriting the story of South Africa, and eliminating poverty and reducing inequality by 2030. The goals in the plan have a direct demand on engineers, engineering, and civil engineering in particular.

I have mentioned these goals in previous articles. The NDP is now the document medium-term vision and mission statement for South Africa, and clearly states that all of us must take action to secure South Africa’s future.

The Minister of Finance, Mr Pravin Gordhan, in his budget speech in February this year, announced a spending of R3.2 trillion for more than 43 different major infrastructure projects – R845 billion for the Medium-Term Expenditure Framework.

So it appears then that we have embarked on a new struggle – another revolution that now relates to infrastructure and industrialisation, and the goals are to be met before 2030. An evolution of a nation through Civil Engineering Infrastructure works – a Civil Engineering Revolution – a CIVILUTION.

A towering South African leader, Walter Sisulu, wrote on his prison cell wall: “…in a certain sense, the story of our struggle is a story of problems arising, and problems being overcome…”

Solving problems – here’s that theme again.

I have read in the annals of SAICE’s 110-year history of how civil engineers have influenced the direction of South Africa since 1903 – that civil engineers have affected the future of South Africa over the last century through formal intervention in infrastructure planning and development, and socio-economic development and politics.

In this CIVILUTION, when they talk about us civil engineers in the next 110 years, what will they say of us? Will they say of civil engineers who lived between 2012 and 2030 that this was their finest hour? Where were they? What were they doing? What difference did they make?

We are telling their stories.
ON THE COVER
Because Bigen Africa, a leading infrastructure development company, understands the continent's unique challenges, their project strategies address the full spectrum of community issues that are likely to impact on people’s lives. The company has a network of 16 offices across southern Africa, with a further eight offices in the rest of Africa.

PUBLISHED BY SAICE
Block 19, Thornhill Office Park,
Bakkier Street, Vorna Valley, Midrand
Private Bag X200, Halfway House, 1685
Tel 011 805 5947/48, Fax 011 805 5971
http://www.saice.org.za

CHIEF EXECUTIVE OFFICER
Manglin Pillay
Tel 011 805 5947/8
manglin@saice.org.za

EDITOR
Verelene de Koker
verelene@saice.org.za
Tel 011 805 5947/8, Cell 083 378 3996

EDITORIAL PANEL
Marco van Dijk (chairman), Irvin Luker (vice-chairman), Martin van Ween (president), Manglin Pillay (CEO), Andile Gqaji, Gerhard Heymann, Jeffrey Mahachi, Jones Moloisane, Beate Scharfetter, Phuti Seopa, Marie Ashpole, Verelene de Koker (editor), Elsabé Maree (editor’s assistant), Barbara Spence (advertising)

ANNUAL SUBSCRIPTION RATE
SA R575.00 (VAT included), International US$ 122.00

ADVERTISING
Barbara Spence, Avenue Advertising
barbara@avenue.co.za
Tel 011 463 7940, Fax 011 463 7939
Cell 082 881 3454

DESIGN AND REPRODUCTION
Marketing Support Services, Menlo Park, Pretoria

PRINTING
Ultra Leo, Johannesburg

The South African Institution of Civil Engineering accepts no responsibility for any statements made or opinions expressed in this publication. Consequently nobody connected with the publication of the magazine, in particular the proprietors, the publishers and the editors, will be liable for any loss or damage sustained by any reader as a result of his or her action upon any statement or opinion published in this magazine.

ISSN 1021-2000

FROM THE CEO’S DESK

Civilution ............................................................................................................. 1

URBAN AND RURAL ENGINEERING

Nelson Mandela Bay Municipality Water Loss Programme ............................. 9
Innovative water supply solutions for the Greater Hermanus Area ............. 19
Enkanyezini and Kwangwanase rural water supply projects at Manguzi, near Kosi Bay ..................................................... 24
The effect of densification on water and sewer networks ............................. 31
Dealing with the rural sanitation backlog in the Chris Hani District Municipality - a case study ..................................................... 34
Swakopmund Municipality’s new wastewater treatment plant ................. 40
SAICE supports Green Drop! .......................................................................... 47
Integrated planning for service delivery in municipalities ......................... 50
eThekwini Metropolitan Municipality’s integrated approach to pavement asset management .................................................. 55

SANRAL tackles poverty and unemployment in the OR Tambo District Municipality ................................................................. 63

Labour-intensive construction in SANRAL community development projects: the role and involvement of the community ................ 70

IN BRIEF 73

- First 40 m² CMA House opens a door to better housing delivery - DSM opts for Chryso pre-sealer to enhance façade of acclaimed retirement complex - Massive retaining walls constructed for Massbuild warehouse

SAICE AND PROFESSIONAL NEWS

Exceptional honour for SAICE’s president .................................................. 78

The latest SAICE journal ................................................................. 79

Letter: Facts and fiction about e-tolling .................................................. 80

SAICE Training Calendar 2012 ................................................................. 80
Sub-Soil Stability is Non-Negotiable

Kaytech has the widest range of drainage and filtration products, to meet your specific sub-soil drainage needs.

From reservoirs to retaining walls, from paving and paths to highways and high rises and from steep slopes to sports fields, Kaytech has the products and professional engineering support to give you the complete solution.

For more information, contact Kaytech today.

- Pre-manufactured panel drains and drainage nets
- Extruded drainage pipes
- Underground drainage chambers for storm water and waste water soak-aways
- Recycled and sustainable products

Johannesburg 011 922 3300
East London 043 727 1057
Cape Town 021 531 8110
Durban 031 717 2300

www.kaytech.co.za
BIGEN AFRICA, one of South Africa’s leading infrastructure development companies, has been appointed as consulting engineers for a ground-breaking housing project in Scottsdene, Kraaifontein, in the Western Cape, by the developer Calgro M3 Holdings. Bigen Africa will undertake the management and design of all civil engineering work required for this project, which follows government’s new approach to developing integrated human settlements by actively involving private sector funders.

According to the parties involved, this new approach is set to be more successful in addressing the national housing backlog. Despite the fact that 2.8 million houses have been built since the advent of democracy, South Africa has “hardly moved in breaking the [housing] backlog at a rate of just 10% per annum,” says Tokyo Sexwale, Human Settlements Minister.

“This project is an encouraging and decisive step in the right direction, and one which addresses both the housing backlog and the high levels of unemployment,” says Deon Fabel, Executive Director: RSA South at Bigen Africa. “By actively involving private sector funders, government will go a long way towards achieving Minister Sexwale’s challenging target of delivering 220 000 homes a year between 2010 and 2014.”

The four-year integrated housing project, which was started in January this year and is set to be completed in 2015, is an example of successfully building a truly integrated community, and is the first of its kind to be implemented in the Western Cape.

“The idea behind this development is to not only rely on government funds for housing development,” explains Patricia de Lille, executive mayor of Cape Town, “but to also draw in the private sector to balance the forces in the housing market.”

The development of infrastructure and transport services will benefit more than 2 000 families to be housed in the 22 ha settlement – residents will now have water and electricity services, and a network of tarred cycling lanes, sidewalks and taxi bays, all of which will also be to the advantage of the wider community in the northern suburbs of Cape Town.

Complete infrastructure development is being achieved through the public/private partnership between the City of Cape Town and Calgro M3 Holdings.

“Experts from the full spectrum of property development and construction are involved in this project,” says Willem Steenkamp, Western Cape divisional director of Calgro M3 Holdings, “and they have the know-how to ensure quality lower-cost housing.”

The more than 2 000 housing units to be constructed will consist of:

- Nearly 550 semi-detached, double-storey ‘Reconstruction and Development Programme’ (RDP) houses, also known as ‘Breaking New Ground’ units; these are fully subsidised units.
- Approximately 350 community residential units which are subsidised rental units owned by the municipality; these will consist of three to four-storey flats in blocks of 24 to 40 units.
- Social housing units, also consisting of three to four-storey flats in blocks of 24 to 40 units; these are rental units for households and are partially subsidised.
- Approximately 200 affordable units for the gap housing market, which are free-standing, single-storey homes offering a choice of house plans.

The bulk and link services will be funded by the City of Cape Town through the Urban Settlements Development Grant (USDG) programme and the required development contributions by the developer.
The internal services for the subsidised units will also be funded through the USDG programme. The internal services for the non-subsidised units will be the responsibility of the developer.

A new taxi transfer station at Scottsdene will be built as part of this project. At present there is an informal taxi transfer station with no supporting infrastructure. The new taxi routes within the Scottsdene road network will be incorporated into existing taxi routes in the region, ensuring easy access for future commuters. Proper taxi bays along these new routes will improve the safety of public transport users.

The bulk infrastructure in the region will be upgraded as part of this housing project. The bulk water line from the existing reservoirs which serve Scottsdene and Wallacedene will be upgraded, along with two sewage pump stations and the current wastewater treatment works. Also included in the project is the rehabilitation of an existing retention pond.

Certain sections of Old Paarl Road, one of the main roads serving the area, will be upgraded as well. This includes the intersection between Old Paarl Road and Okavango Road, as well as a part of Old Paarl Road leading to Krugersfontein Road.

When completed, the Scottsdene project would have achieved the goal of creating a better life for this community, showing that government and the private sector can work together successfully to better the lives of South Africans.

"Bigen Africa’s involvement in the implementation of this project has, once again, convinced us of the significant benefits that can be derived from an integrated approach to housing delivery. This approach is in alignment with Bigen Africa’s policy of bringing together the key success factors that will attract private sector funders to public sector projects," says Deon Fabel.

“We remain committed to empowering disadvantaged individuals, and to supporting job creation and the initiatives of the government’s Expanded Public Works Programme, by facilitating accredited skills training during the development and construction of projects such as these.”
Let’s go for more kilometres between engine overhauls.

Delo®
Let’s go further.

How do we do it? Delo® ISOSYN® products utilise our special ISOSYN® Technology, which combines premium base oils, high performance additives and Chevron formulating expertise to provide superb diesel parts protection that rivals synthetic performance. All at an outstanding value. Delo products with ISOSYN Technology help provide extended service protection, maximise engine durability and minimise operating costs.

Learn how Delo’s family of products can help you go further, visit www.deloperformance.com
The new company that’s 300 years old.

SSI Engineers & Environmental Consultants has a new name and a new look. Even though we start life as Royal HaskoningDHV, we already have over 300 years of combined experience and a worldwide footprint.

Partner with Royal HaskoningDHV in enhancing society together as we create solutions for the sustainable interaction between people and their environment.
INTRODUCTION
The Nelson Mandela Bay Municipality (NMBM) embarked on a large-scale water conservation and water demand management (WC/WDM) programme in 2009. The objective is to reduce non-revenue water (NRW) by 15% within ten years (non-revenue water is the difference between ‘system input volume’ and ‘billed authorised consumption’). The severity of the recent 2009 to 2011 drought in the Eastern Cape resulted in the municipality intensifying many of the WC/WDM interventions, all with the view to reducing NRW and water wastage and improving the sustainability of water services. Since the drought broke and the NMBM lifted their emergency water restrictions, the focus of the Water Loss Programme has shifted, putting more emphasis on initiatives that reduce unbilled authorised consumption and apparent losses.

BACKGROUND
The NMBM abstracts its water from regional water sources and the Lower Sundays River Government Water Scheme. For a number of years the municipality has abstracted its full allocation for water from the Gariep Dam, and demand is presently matching capacity of the various water sources. Figure 1 shows the significant fluctuation in the supply dam levels over the last 37 months, highlighting the importance of water resource and demand management for the municipality.

The NMBM realised the need to implement a comprehensive WC/WDM programme, but has been hampered in its efforts by a lack of capacity. In recent years the Auditor General has queried the increase in non-revenue water. Benchmarking exercises between cities over the last few years have confirmed this. The Department of Water Affairs (DWA) asked the NMBM to put the necessary WC/WDM measures in place to reverse this trend.

The NRW has increased annually since the formation of the NMBM, and was standing at 40.2% of usage at the beginning of the programme. This can be attributed to a number of factors, including:

- Lack of education and awareness regarding water conservation amongst consumers, including the youth
- A high increase in water demand without a corresponding increase in water revenue
- Water losses on water supply networks attributed to ageing infrastructure, as well as newer infrastructure that has been poorly installed
- Poorly maintained plumbing infrastructure in households in low-income areas
- High numbers of leaking water meters
- The NMBM being unable to capacitate and successfully deploy a WC/WDM section
- No active leak detection programme
- Un-metered connections and water meters not on the billing system

![Figure 1: Storage capacity of the Nelson Mandela Bay Municipality dams (2009 to 2012)](image-url)
High water losses at many state schools. The need for a dedicated WC/WDM section was identified during the formation of the NMBM, and the organisation’s organogram, which was created at the time, reflects this. However, due to the shortage of technical skills and despite numerous advertisements, no suitable posts could be filled. The NMBM have subsequently looked into employing suitable professional service providers (including management) to assist in implementing WC/WDM programmes.

The NMBM therefore appointed Uhambiso Consult (Pty) Ltd to assist in the development and implementation of an integrated WC/WDM strategy. This has led to the NMBM accepting an integrated water resource management approach to be implemented over the next ten years.

**METHODOLOGY FOR LEAKAGE MANAGEMENT**

The methodology for leakage management, as provided by Hydro-Comp Enterprises, is currently being implemented by the NMBM. This entails the following steps:

1. Zone prioritisation and identification
2. Preliminary water balance
3. Analysis of maintenance work
4. Recommendations for pressure management
5. Evaluation of minimum night flow results
6. Network analysis/zone calibration
7. Completion phase and zone commissioning.

As a starting point, the NMBM water supply system has been sectorised into approximately 203 zones using the EDAMS water and sanitation management system, which is a GIS-based engineering management information system.

In conjunction with this initiative, the NMBM identified the need for water loss services to be carried out.

**WATER LOSS SERVICES**

The NMBM appointed a service provider, Re-Solve Consulting (Pty) Ltd, in April 2010 to provide water loss services, as part of the Water Loss Programme over a three year period. This work is carried out, zone by zone by dedicated teams assessing all components of the water supply system.

<table>
<thead>
<tr>
<th>Domestic area</th>
<th>Number of connections audited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motherwell</td>
<td>30 864</td>
</tr>
<tr>
<td>Wells Estate</td>
<td>3 956</td>
</tr>
<tr>
<td>Khayamandi</td>
<td>2 257</td>
</tr>
<tr>
<td>Kamvelihle (2nd sweep)</td>
<td>3 186</td>
</tr>
<tr>
<td>iBhayi</td>
<td>37 492</td>
</tr>
<tr>
<td>Aspen Heights</td>
<td>408</td>
</tr>
<tr>
<td>North End (Domestic)</td>
<td>374</td>
</tr>
<tr>
<td>Kabah</td>
<td>4 896</td>
</tr>
<tr>
<td>Jacksonville</td>
<td>1 121</td>
</tr>
<tr>
<td>De Mist</td>
<td>98</td>
</tr>
<tr>
<td>Bethalsdorp</td>
<td>3 234</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>87 886</strong></td>
</tr>
</tbody>
</table>

**Domestic consumer meter audit progress mid-2012 (87 886 consumers)**

![Figure 3: Graph of meter faults identified by the Water Loss Programme](image-url)
To date the following remedial work has been completed for the residential areas investigated by Re-Solve Consulting:

- Community-based semi-skilled plumbers have been appointed and trained to carry out leak repairs and install volume-control meters for registered indigent consumers with leaking plumbing infrastructure (pipework, fittings, taps and toilet cisterns). For toilet leaks, the cistern is replaced with a siphonic action mechanism.
- Leaking and faulty meters (most severe in more recently developed low-income areas) are repaired or replaced by contractors working under the NMBM Water Installation Workshop.

Efficiency through Engineered Solutions

- Water Demand and Loss Management
- Project Management and Contract Administration
- Technical Support to Development Agencies
- Climate Change Response Planning
- Water Supply Services
- Environmental Management
- Infrastructure Assessments and Efficiency Audits
- Instrumentation and Measurement
Un-metered properties and community standpipes have been metered and the necessary updates to the billing system carried out. Valve and fire hydrant faults (not shown on drawing, incorrectly shown on drawing, no cover/manhole, missing marker, not working) have been corrected by contractors and updated on as-built drawings where applicable. Large leaks/pipe bursts are repaired by the NMBM (typically within 24 hours). Once all visible leaks have been repaired and the zone made discrete, certain hydrants in the zone are level-surveyed and accurate pressure readings taken. These readings are used for network analysis/zone calibration, undertaken by Hydro-Comp Enterprises (Step 4 above of the Methodology for Leakage Management), to identify areas with hidden/underground leaks. These leaks are then located (using advanced leak detection equipment where necessary) and repaired, and a further flow analysis undertaken until the water losses have reduced to an acceptable range.

A comprehensive education and awareness campaign which made extensive use of the media, including newspapers, billboard advertisements and radio, was carried out by the municipality during the drought period to complement the technical interventions.

The NMBM is currently investigating the feasibility of implementing a combined debt management and active domestic leak repair programme. This will target residential consumers with high leakage on plumbing infrastructure coupled with a poor payment history for water services.

Water loss interventions: Motherwell, Kamvelihle

The flow logging results provided in Figure 6 for Motherwell, Kamvelihle, show excessively high minimum night flows (lowest consumption usually between midnight and 4 am) measured in August 2010 prior to the water loss investigations and follow-up interventions. This is compared with a reduced minimum night flow measured in May 2012.

Interim logging results (taken in July 2011) showed that the leakage actually increased in the area following a first phase of interventions. The cause of the increase in water loss can be attributed to a number of factors, such as:

- An increase in pressure in the network (as a result of the first round of leak repairs) resulting in an increase in on-site leakage (failure of or leaking plumbing fittings on properties).
- Poor quality control of contractors installing on-property pipework and network connections (too shallow).
- On-going road construction in the area undermining the water supply infrastructure (damaging pipes).

The second phase interventions of all properties were then carried out by water loss teams (second sweep). This included:

- Stormwater investigation
- Advanced leak detection (J Moorcroft – Underground Leak Detection).

Targeted interventions following the second sweep included:

- Leak repair (municipal infrastructure)
- Meter replacements
- ATTP repairs (indigent household repairs).

It is noted that the excess night flow for the zone has been reduced by 19.1 kl/hr (22%) as a result of the interventions (excess minimum night flow calculated using the WRC SANFLOW Software). Sewer logging results taken pre- and post-interventions show a reduction in the minimum night flow of 5.1 kl/hr. The minimum night flow (MNF)/average flow ratio was reduced from 83.5% to 67.9%. The logging results also show, however, that there is still significant scope to further reduce leakage in the supply area. The results of the sewer losses are provided in Figure 7.
As a general rule, steel strips are used as reinforcing material in the design of REINFORCED EARTH® structures. Polymeric reinforcements are used with appropriate connections in the event of special conditions.

Road and Rail Applications
- Retaining Walls
- Approach Ramps to Bridges
- Bridge Abutments – True and Mixed
- Widening of Cuttings

As a general rule, steel strips are used as reinforcing material in the design of REINFORCED EARTH® structures. Polymeric reinforcements are used with appropriate connections in the event of special conditions.
CIVIL ENGINEERING SOFTWARE
For the latest in true integrated design for civil engineering, surveying and mining/geology.

DatumMate
WGS 84 Datum Conversion of Drawings

WaterMate
Water Reticulation Design and Static Analysis and Time Simulation

AutoTurn
Vehicle Manoeuvre Simulation/Analysis

RoadMate
Urban/Rural Road Design

AeroTurn
Aircraft Movement/Space Analysis

SurfMate
Survey/Digital Terrain Modelling

ParkCAD
Automated Parking Area Layouts

PipeMate
Sewer & Stormwater Design and Analysis

AutoCAD Civil 3D
DTM, Site Development and Transportation

RebarMate
Reinforced Concrete Detailing and Scheduling

TECHNoCAD TRAINING
TECHNoCAD provides professional training and support for both TECHNoCAD civil engineering application software and Autodesk products. Our new state-of-the-art training facility provides courses varying in duration from one day to four days. For our course schedule, visit our web site or email us at admin@technocad.co.za.

NEW! Now available for AutoCAD 2012

www.technocad.co.za • sales@technocad.co.za
Tel +27-11 803 8834 • Fax +27-11 803 3452 • TECHNoCAD, P.O.Box 87, Rivonia 2128

Autodesk Authorised Developer
Autodesk Authorized Value Added Reseller
logging show a reduction in the minimum night flow of 5.1 kl/hr. The contributing factors to this reduction include the ATTP repairs (indigent household repairs). The revenue comparison in Figure 7 shows the combined impact of the Water Loss Programme in decreasing water losses. Non-revenue water has decreased through the various interventions targeting leakage while revenue water has increased through improved metering, meter-reading and billing. The return on investment has been calculated to be 16 months after the reduction of the MNF.

**Water Loss Interventions: Bluewater Bay**

An example of a middle-income area targeted during the Water Loss Programme is Bluewater Bay. Interventions undertaken in this supply zone include:
- Step testing (to apportion water loss per area within the supply zone)
- Active leak detection
- Valve and hydrant repairs/replacement
- Consumer meter audit
- Advanced pressure management

Following the completion of various remedial interventions, including the repair/replacement of valves and hydrants and the repair of network leaks, a data logging exercise (pressure and flows) was repeated to assess the potential for advanced pressure management. Following positive analysis of the results, a new zone inlet meter and pressure reducing valve with advanced control (time and flow modulation) supplied by Dynamic Fluid Control (DFC) was designed. Camdekon Engineers, supported by the NMBM, arranged the installation.

The combined impact of the water loss interventions, most notably the installation of a correctly sized pressure reducing valve with time-based and flow modulation.

**Figure 6: Flow logging results for Motherwell, Kamvelihle (August 2010 & May 2012)**

**Figure 7: Revenue comparison for Motherwell (August 2010 – May 2012)**
(activated in the event of a fire within the zone), has resulted in a significant reduction in night flows in Bluewater Bay. The MNF/average flow ratio was reduced from 65.8% to 28.5% (MNF reduced from 57.6 kl/hr to 14.1 kl/hr), while the excess MNF has been reduced by over 80%.

The return on investment for the interventions undertaken in Bluewater Bay as part of the Water Loss Programme has been calculated to be less than six months.

### Industrial, Commercial and Institutional Consumers

Included in the water loss services undertaken by Re-Solve Consulting, is an audit of industrial, commercial and institutional (ICI) consumers. This process includes the following:
- Valve and fire hydrant audit of industrial and commercial zones
- Meter audit
- Leak detection (visual and sounding)
  - Mains
  - Valves and fire hydrants
  - Meters.

The NMBM has identified schools as a priority component of the ICI audit due to significant potential to reduce water loss in schools. This is mostly due to dilapidated plumbing infrastructure, inefficient water use practices and low levels of payment for services.

The following industrial and commercial areas have also been targeted by the programme:
- Neave Industrial
- Perseverance
- Markman
- Struandale
- Deal Party

The results for all the Industrial areas audited to date (Figure 9) indicate the type of meter issues that are actioned as a result of the Water Loss Services Programme. Significant potential for improved revenue collection has been realised by the municipality by implementing this comprehensive ICI audit. This audit also included targeting

---

### Figure 8: Flow logging results for Motherwell, Kamvelihle (November 2010 and June 2012)

![Flow logging results](image)

### Area Industrial

<table>
<thead>
<tr>
<th>Area</th>
<th>Audit</th>
<th>Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connections</td>
<td>Valves &amp; Hydrants</td>
</tr>
<tr>
<td>Neave Industrial</td>
<td>No Off</td>
<td>136</td>
</tr>
<tr>
<td>%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Motherwell ICI</td>
<td>No Off</td>
<td>52</td>
</tr>
<tr>
<td>%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>Markman Industrial</td>
<td>No Off</td>
<td>66</td>
</tr>
<tr>
<td>%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Perseverance Industrial</td>
<td>No Off</td>
<td>50</td>
</tr>
<tr>
<td>%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>Struandale Industrial</td>
<td>No Off</td>
<td>26</td>
</tr>
<tr>
<td>%</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>Uitenhage</td>
<td>No Off</td>
<td>284</td>
</tr>
<tr>
<td>%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Deal Party</td>
<td>No Off</td>
<td>152</td>
</tr>
<tr>
<td>%</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>New Brighton ICI</td>
<td>No Off</td>
<td>217</td>
</tr>
<tr>
<td>%</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>North End Industrial</td>
<td>No Off</td>
<td>619</td>
</tr>
<tr>
<td>%</td>
<td>3%</td>
<td>11%</td>
</tr>
<tr>
<td>TOTAL ALL INDUSTRIES</td>
<td>No Off</td>
<td>1602</td>
</tr>
<tr>
<td>%</td>
<td>2%</td>
<td>1%</td>
</tr>
</tbody>
</table>

---

**Figure 9: Industrial, commercial and institutional consumer meter audit – summary of findings**
the top 100 industrial, commercial and institutional consumers.

The following work has been completed in response to the completed ICI consumer audit:

- Un-metered fire connections found mostly in older industrial/commercial areas have been identified and the NMBM have installed meters.
- Industrial/commercial consumers illegally tapping water from fire hydrants have been identified, the connections have been removed and legal action taken where necessary.
- Valve and fire hydrant faults have been corrected by contractors and updated on as-built drawings where applicable.
- The following meter replacements/installations have been made by the NMBM based on recommendations by Re-Solve Consulting:
  - Faulty/broken meters
  - Inaccurate/old meters
  - Incorrectly sized meters
  - Incorrect type of meters
  - Poorly installed meters.

The consumer records have also been updated to reflect the above changes. The ICI consumers account for a significant portion of the water use in the NMBM. The benefit of this portion of the water programme in reducing NRW is therefore significant.

Figure 10 shows the impact of the Water Loss Programme in just one of the industrial areas where eight consumers were targeted as a result of the ICI audit (850% increase in revenue over a projected 36 months).

The NMBM have identified various initiatives, including projects co-funded by the private sector, to combat high water wastage in schools.

A total of 100 jobs have been created as a result of the municipality implementing the Water Loss Service Programme. Significant effort has also been put into capacity building to ensure that the skills developed during the programme can be used by the municipality going forward.

CHALLENGES

Challenges faced by the service provider in implementing the Water Loss Services Programme have included:

Leading consultant in the Eastern and Southern Cape in the water sector

“It is all about water management”

Uhambiso has a proven track record with WCDM (Water Conservation & Demand Management) both in terms of strategy formulation and implementation. Managing of corrective and maintenance interventions to secure positive results;

A valued service provider to the Department of Water Affairs, Nelson Mandela Bay, Baviaans, Camdeboo, Makana and many other municipalities;

Training and development of operators, artisans and community based plumbers to do basic repairs and maintenance;

We have an established network of specialists that partner with us on water management projects and awareness and education campaigns;

Uhambiso Consult

“We Deliver”
Concrete Solutions To Common Problems!

A.SHAKEPOXERITE have been reliably solving problems in the construction industry since 1968.

A.SHAKEPOXERITE provides the Civil, Mining & Construction Industries with an innovative range of affordable quality and African Tough construction chemical solutions, such as:

Cementitious Patching
- Principal uses:
  - Structural repairs to concrete.
  - Restoration of spalled and damaged concrete.
  - Repairs to honeycomb.
- Advantages:
  - Easy to mix, apply and finish.
  - Excellent adhesion.
  - Shrinkage compensated.

Cementitious Grouting
- Grouts are available in various formats:
  - High Strength Non-shrink Fluid.
  - Precision Flow.
  - Fibre Reinforced.
  - Sub-Zero, Rapid Setting.
  - High Strength Non-shrink Structural.
  - Epoxy 3 part Grout is also available.

E222 Chemical Anchor
- Principal uses:
  - As a resin for chemical anchoring.
  - Fixing starter bars, bolts, etc., vertically down into concrete.
- Advantages:
  - Superior adhesion to most building materials.
  - Chemical resistance.
  - Stronger than surrounding concrete.
  - High strength and modulus.

E505 Supascreed Acid Tech
- Principal uses:
  - As a protective liner for concrete and steel where acidic materials are used.
  - Bunded areas for the safe storage of acidic materials.
  - Protection coatings for storage tank liners.

WAY FORWARD
The NMBM Water Loss Programme has to date achieved significant success through the implementation of the various interventions discussed, including reducing physical losses from 29.3% (27 560 584 kl/yr) to 21.0% (19 272 764 kl/yr). NRW has been reduced from the 40.2% at the start of the programme to 36%. Combined savings as a result of the programme are estimated to be in the region of R16.2 million for the 2011/12 year. The goal to reduce NRW by 15% in ten years is obtainable, given the success of the Water Loss Programme to date and the intent to continue to roll-out sustainable, targeted interventions going forward.

CONCLUSIONS DRAWN FROM WATER LOSS PROGRAMME
- Ensure good standards in material, workmanship and quality control in new housing developments. Experience has shown that most internal leaks occur on RDP housing projects, and in particular, on toilet cisterns.
- Where roads are constructed as a later phase to services and houses, there is a big risk that services will be damaged or affected. Higher specification and site supervision in these cases need to be considered, such as installing road crossings in pipe ducts and increased pipe cover.
- Experience indicates that an area needs to be investigated at least three times. As leaks are repaired, pressure increases and new leaks develop.
- Proper awareness and education about services must be provided to recipients prior to houses being handed over.
- Pressure management must go hand in hand with leak repair programmes.
- Delivery of a sustainable service requires an on-going Water Loss Programme, not once-off exercises, but continual monitoring and analysis as a basis for targeted interventions.
- An effective Water Loss Programme will provide an excellent return on investment.

ACKNOWLEDGEMENT
The Nelson Mandela Bay Municipality is thanked for their support and for the use of their data.

Tel: +27 11 822 2320
Fax: +27 11 822 2354
Website: ashakepoxerite.co.za
Email: cindy@ashak.co.za
George@epoxerite.co.za

Call us for more Information.
We also terminate and recommend products for your specific needs.
Experience a positive relationship in business with people who care and deliver results.

A-SHAK EPOXERITE, 2012 Edition
BACKGROUND

The catchment area of the De Bos Dam, which is the main water source for the Greater Hermanus Area, has experienced one of its most severe droughts in recent history, during a period stretching from September 2010 to April 2012. The dam content had dropped to below 20% of its full supply capacity by April 2012.

The Greater Hermanus Area consists mainly of coastal towns, which have become famous as holiday destinations, resulting in major growth due to population infiltration, which peaks during the April and year-end school holiday periods. These periods respectively coincide with the middle and end of the dry season of the water supply catchment area.

Preekstoel Water Treatment Works, which is located west of Hermanus, near the Hemel and Aarde valley, was originally constructed in 1974, with a capacity of approximately 14 Mℓ/d. It was designed specifically to treat surface water from the De Bos Dam. In 1988 it was upgraded by replicating the original sedimentation tanks and filters in a mirror-type configuration, thereby doubling the capacity to 28 Mℓ/day. The original filters were also refurbished at the turn of the millennium.

The Overstrand Municipality has realised that this supply and treatment system will be insufficient to cater for future demand growth, especially in view of the drought recently experienced.

THE SOLUTION

The municipality has engaged in the development of a series of groundwater well fields, with the intention of supplementing the surface water sourced from the De Bos Dam. However, the groundwater is rich in iron and manganese, which must be removed to prevent problems ranging from aesthetics and staining, to clogging of the distribution network with gelatinous bacteria that use iron and manganese in their metabolism.

The existing treatment works is not able to remove the iron and manganese, and hence specific treatment of the groundwater is required. An add-on dosing system was provided around 2007 to deal with water from the first well field at Gateway, but with the expansion of the groundwater scheme, it became necessary for the treatment of the various well fields to be integrated and a tailored process to be designed, to ensure reliable achievement of target water quality. This is particularly necessary as the groundwater will in future make up a substantial portion of the total quantity treated at the Preekstoel Water Treatment Works.

To cater for the growing demand of the Greater Hermanus Area, especially during peak holiday periods, a new project was implemented to increase the water supply and treatment capacity until 2020 and beyond.
PROJECT DESCRIPTION

The project comprises the following main aspects:

■ Refurbishment of the existing treatment works infrastructure, parts of which are now 38 years old, to enable delivery in line with its full original design capacity.

■ Provision of power supply and equipment for the various boreholes, as well as the strategic management of the groundwater supply system to ensure the sustainability thereof.

■ Conveyance of groundwater supplies from various sources to a dedicated centralised treatment works located adjacent to the existing Preekstoel Water Treatment Works.

■ Construction and implementation of a new treatment works, which has been specifically designed to treat water from the iron- and manganese-rich groundwater sources.

PROBLEMS ENCOUNTERED AND INNOVATIONS

Small sections of the existing works were decommissioned, refurbished and re-commissioned at a time to minimise disruption of the water supply and treatment system. Construction activities were also programmed to ensure that the full works was operational during the peak holiday periods. Although water restrictions were put in place during the drought period, no water supply cut-offs were required for construction purposes during any stage of the refurbishment period.

Most of the borehole wells are located on private properties, some of which are being used for organic farming. A large...
Our fly ash concrete is strong and durable with good thermal and structural qualities, providing the owner with an affordable, comfortable, long-lasting home.
We congratulate The Woodlands Sewer Upgrade Project Team on the Environmental Engineered Solution by softening rock filled Gabions with Biomac® in order to foster endemic seeds to grow.
A pilot plant was erected at Kleinmond to familiarise operations staff with the operational difficulties and requirements. After an initial trial period this plant has consistently delivered treated water that complies with the SANS 241 limits. The biological process was therefore proposed for the treatment of the iron and manganese from the boreholes in the Hermanus area.

**PROJECT STATUS**

The installation of the electrical power supply cables to the various boreholes and works has been completed by ESKOM. All borehole wells have been drilled and lined. Centrifugal borehole pumps were ordered in July 2012 and are due to be installed by November 2012. Except for a section of pipeline on Camphill Farm, the borehole supply pipeline network has also been completed.

The refurbishment of the existing treatment works has been completed and most facilities have been re-commissioned. The civil and structural construction work of the new biological treatment plant is due for completion by December 2012 and the works is due to be commissioned in March 2013.

**PROJECT TEAM**

<table>
<thead>
<tr>
<th>Implementing institution</th>
<th>Overstrand Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-funding agent</td>
<td>Regional Bulk Infrastructure Grant channelled through the Department of Water Affairs</td>
</tr>
<tr>
<td>Designers, Project Managers and Geotechnical Consultants</td>
<td>Aurecon</td>
</tr>
<tr>
<td>Geohydrological Consultants</td>
<td>SRK and Umvoto</td>
</tr>
<tr>
<td>Environmental Consultants</td>
<td>SRK</td>
</tr>
<tr>
<td>Main Contractors</td>
<td>Inyanga Projects, Inenzo Water and PCI</td>
</tr>
<tr>
<td>Health and Safety Agents</td>
<td>Smartsafe and Aspirata</td>
</tr>
<tr>
<td>Environmental Control Officer</td>
<td>Ecosense</td>
</tr>
</tbody>
</table>

The biological treatment plant (a first for South Africa) under construction in Hermanus.
Enkanyezini and Kwangwanase rural water supply projects at Manguzi, near Kosi Bay

BACKGROUND

In early 2004 Jeffares & Green (J&G) was appointed by Aquamanzi Developments and Mhlathuze Water to prepare Department of Water Affairs and Forestry (DWAF) Version 3.3 Project Business Plans for the Enkanyezini Phase 2 and Kwangwanase Phase 3 Community Water Supply Schemes respectively. Both Aquamanzi Developments and Mhlathuze Water were acting as implementing agents for the uMkhanyakude District Municipality (UDM).

The two schemes are very close to each other and are hydraulically linked. They are therefore considered as one regional rural scheme, with all of the below referring to the elements of both schemes.

In 2006 J&G’s appointments were extended to cover the implementation of both schemes, which are located within five municipal wards around the town of Manguzi in Maputaland, northern KwaZulu-Natal (KZN), and also extend from there up to the Farazella border post on the Mozambique border.

J&G’s involvement in the scheme has therefore been from 2004 until September 2012 when the scheme was commissioned, operation and maintenance (O&M) documentation compiled, operator training carried out and the scheme handed over to the UDM.

Manguzi is near Kosi Bay, which is located within the uMhlabuyalingana Local Municipality, which in turn falls under the jurisdiction of the UDM, who is the Water Services Authority (WSA) for the district. The rural area around Manguzi also falls under the Tembe Traditional Authority under Inkosi M I Tembe and his Council. The scheme extends north-south for about 25 km, bordering on Mozambique in the north, and extends west-east for about 20 km, bordering on the Greater St Lucia Wetland Park in the east.

AIMS AND OBJECTIVES

The existing Phase 1 of Enkanyezini and existing Phases 1 and 2 of Kwangwanase were implemented by others during the early and mid-1990s, and were designed to supply potable water to RDP (Reconstruction and Development Programme) standards to an estimated consumer base of about 15 000 people in 2004.

The estimated total population in the proposed supply area of this scheme in 2004 was about 58 000 people, therefore indicating a large backlog in potable water supply at that time.

The current scheme is designed to supply potable water to an estimated current population of about 73 000 people. This number is expected to increase to about 98 000 at the end of the 15-year design horizon, ending in 2022.

The main aim of the scheme is to supply safe, potable water to the local population in and around Manguzi town, and to also reduce the time spent by many of the womenfolk in the traditional and arduous task of collecting water, thus enabling them to play a more meaningful role in the economy of the area.

Other aims of the scheme were to provide temporary employment in the area, to boost the economy of the area and to leave as many technical skills behind as possible to improve the employment potential of community members.
DESIGN CRITERIA AND PHILOSOPHY

The design criteria used were based on the Department of Water Affairs (DWAF) RDP Rural Water Supply Design Criteria Guidelines, First Edition, October 1997.

This essentially involved the supply of potable water to all consumers in the supply area via communal standpipes within a maximum one-way walking distance of 200 m from any homestead, at an average annual daily demand (AADD) of 25 ℓ/p/day. The infrastructure was designed for an AADD of at least 60 ℓ/p/day to allow for an improvement in the level of service over time to yard-taps or house connections, which had mostly already been achieved under the existing phases.

The supply area falls within the Makhathini flats and is generally very flat and sandy, with three main ridges of ancient vegetated dunes running north-south through the west and centre of the supply area, forming local water-sheds.

Raw water was sourced from 12 production boreholes, two perennial streams and a natural lake. Wherever feasible, this water was treated as closely as possible to its source to minimise the distance required to pump raw water, thereby minimising sedimentation accumulation in the pumping mains. After treatment the water is then pumped to storage reservoirs distributed along the water-sheds for distribution to communities under gravity.

Consideration was initially given to reinforced concrete ground-level reservoirs at some of these local high points, with elevated galvanised mild steel (GMS) tanks alongside, and elevated GMS tanks only at the other locations.

These locations are mostly very isolated and accessible only by narrow sandy tracks through thick coastal vegetation, making concrete reservoir construction using grade 35A/19 MPa concrete to standard very difficult, costly and time-consuming. It also meant constructing costly electricity supply infrastructure to these points to lift the water to the elevated tanks alongside.

J&G therefore decided, together with the project team, to elevate all storage at these points on either 10 m, 15 m or 20 m high GMS stands, as required, which would make reservoir construction by steel tank sub-contractors quicker and provide as much head above ground as possible at all these points, negating the need for localised pumping.

J&G decided to try and minimise pumping and pumping distances to these tanks as much as possible, and to maximise distribution under gravity from each elevated tank within its particular supply area.

HDPe pipes were used up to and including 90 mm dia with uPVC pipes being used for larger diameters. Although 90 mm dia HDPe piping was marginally more expensive than 90 mm dia uPVC, the HDPe piping could be laid quicker, with joints only every 50 m instead of every 6 m in a slightly lower grade of bedding material. It is also a more robust and appropriate material for this rural application.

In about mid-2006 Eskom imposed a moratorium on any further electricity supplies in the general area due to network constraints on their Makhathini line. This had serious implications for the scheme, which needed seven new supplies and five existing supplies requiring upgrading. Thankfully this moratorium was eventually lifted in early 2009, but obviously resulted in numerous delays with related costs.

Every effort was made by J&G to concentrate the need for electricity, for raw and potable water pumping, and for water treatment as closely as possible to main road R22 which runs...
through the middle of the supply area and through Manguzi to Mozambique. Eskom’s line generally follows this route, which would minimise the extent of new Eskom infrastructure, thereby saving time and costs.

J&G focused the design and implementation philosophy of this scheme more on simplifying the long-term O&M of the scheme and related costs, through appropriate technology, and less on the short-term capital construction and related costs, although these were obviously an important factor. This was done by providing electrical and mechanical plant, and civil infrastructure of sufficiently high and appropriate quality and standard for ease of O&M.

During the various implementation stages of the scheme, efforts were made to try and involve the same reliable, experienced and locally (KZN) based service providers throughout (such as pump, electrical control panel and water treatment plant manufacturers/suppliers) to minimise the number and costs of role-players giving on-going support to the scheme during its operational life.

**PROJECT DESCRIPTION**

**Technical**

The scheme consists of the following main components:

- 318 km of HDPe and uPVC gravity and pumping mains, varying from 20 mm to 90 mm dia in HDPe, and 110 mm to 315 mm dia in uPVC
- approximately 1 350 valve and meter chambers
- 760 communal standpipes
- 17 elevated GMS tanks, varying in size from 45 Kℓ to 620 Kℓ net storage capacity on GMS stands 10 m, 15 m or 20 m high
- five ground level GMS or concrete reservoirs, varying in size from 100 Kℓ to 225 Kℓ
- 12 new or upgraded production boreholes
- two reconstructed stream abstractions and one reconstructed lake abstraction
- six small water treatment plants (WTPs), varying in capacity from 0.2 Mℓ/ℓ to 2.7 Mℓ/ℓ, which included substantial upgrading of the two existing plants
- five high-lift pump stations including electrical/mechanical pumping plant
- two main water offices and five satellite water offices
- security fencing, valve and meter chambers, road and stream crossings, repairs to existing infrastructure, removal of illegal water and electrical connections, security provision, etc
- incorporation of a GSM cellular phone monitoring system to monitor the drawdown and recovery of all boreholes in their respective well-fields and to also monitor all other relevant pumping equipment (this was done to provide an early warning system, should problems occur, to ensure that the appropriate level of O&M personnel, be it local operator or external service provider, would be alerted early to pumping-related problems, thereby minimising water supply interruptions).

**Institutional and social development (ISD)**

Isango cc and Mokoatsi Community Development Services were appointed as ISD consultants on the Kwangwanase and Ekanyezini projects respectively to assist with the establishment of project steering committees (PSCs) and labour desks. The task of the latter was to facilitate the procurement of local labour for employment by the various contractors and sub-contractors.

The ISD consultants were invaluable in their liaison with all project role-players, including the Traditional Council, especially when it came to dealing with community structures, numerous costly and disruptive illegal water and electrical connections, vandalism, theft and general conflict and dispute resolution.

Ten Expanded Public Works Programme (EPWP) learnerships were involved in the early part of the scheme over three stages (starting in October 2006), with one contract per learnership per stage, in increasing budgeted values of R350 000, R500 000 and R1 000 000. These contracts essentially involved trenching, the supply and installation of pipes and fittings, the backfilling and compacting of the trenches, and the management of the contracts.

Learnership trainees had a separate mentor/trainer, and were also mentored through hands-on training by the two main civil contractors on each project, assisted by J&G’s site supervision staff, comprising a Resident Engineer (RE) and two Assistant REs.

Wherever practical, labour-intensive construction methods were used, both in the learnership programmes and by the main civil contractors.

One of the advantages of working in the area was the soft sandy soils, which made hand excavation for pipe trenching easy and which negated the need to import costly pipe-bedding materials.

**PROJECT IMPLEMENTATION**

The main civil contracts were awarded to Afriscan Construction Pty (Ltd) in March 2007 on the Ekanyezini Phase 2 scheme, and Hidrotech Infra Pty (Ltd) in August 2007 on the Kwangwanase Phase 3 scheme. These contracts were completed in March 2010 and June 2011 respectively.
The final phase of Kwangwanase, Phase 3 Extension, was to have commenced in July 2010, but due to various administrative delays, and a change of scope and procurement approach, eventually commenced almost a year later in June 2011.

Instead of a single contract as for the earlier phases, the contract was split into three, with the civil contract again being awarded to Hidrotech Infra Pty (Ltd), the electrical/mechanical contract to East Coast Irrigation and the pipes and materials supply contract to Thembamanzi cc.

Various sub-contractors were involved in the scheme, providing specialist services, such as the manufacture and/or supplying and installation of elevated GMS tanks and stands, pumping plant, electrical control panels and wiring, water purification plant, plant monitoring, etc.

Geotechnical, environmental and earth science consultants Terratest supervised the drilling of nine boreholes, of which six replaced existing collapsed or vandalised boreholes, and also sleeved two existing boreholes. Extensive drawdown and recovery tests on all boreholes were also done with water quality analyses being carried out by various accredited laboratories.

Of the 12 production boreholes on this scheme, four are located in the Airfield well-field and five in the Thengani well-field. The boreholes in each of these well-fields pump water through shared pumping mains to the Airfield and Thengani WTPs respectively. Due to the variations in depths of the unconfined aquifers, and the shared pumping mains and existing borehole casing sizes, positive displacement borehole pumps were used (not centrifugal pumps).

KROHNE WATERFLUX 3070 C, a battery powered, and maintenance-free electromagnetic water meter.

The WATERFLUX3000 combined with the IFC070 battery powered converter is a reliable solution for remote water monitoring needs in the water industry where no power connection is available and provides certainty in case of power failure.

The IFC 070 compact signal converter is available in aluminium and polycarbonate housing. The signal converter in a polycarbonate housing is suitable for submersion in flooded measurement chambers and is protected to IP68 / NEMA 6P.

Non-wearing and maintenance-free thanks to RILSAN®-lined measuring tube without moving measuring inserts and no need for repair therefore reducing the operating cost. Further, the Rilsan® liner of the flow sensor is highly resistant to pressure or vacuum conditions, to corrosion and aging. The meter can be installed with 0 inlets and 0 outlets before and after the meter due to the rectangular measuring section.

Meter complies with (SABS) now NRCS approval for billing.

Contact details:
KROHNE South Africa
8 Bushbuck Close
Corporate Park South
Randjespark, Midrand
Tel: 011 314 1391
Fax: 011 314 1681
John Alexander
E-Mail: johna@krohnesa.co.za

No need for Maintenance

KROHNE – Water engineering is our world.
The turbidity, colour, iron and manganese determinants in most of the boreholes fell within Class 2 or Class 3 water, which is marginal-to-poor quality water, according to DWAF’s criteria for drinking water.

The treatment for mixed water from these two borehole systems involved dosing with sodium hydroxide to increase the pH in the water, then with sodium hypochlorite to disinfect the water and oxidise the iron, then adding GR150 coagulant to destabilise the colloidal suspension in the water and improve the performance of the pressure filters in the plant.

Raw water at the Gezisa and Nkanini stream abstractions is pumped by a set of submersible pumps, in an abstraction chamber in each stream, tangentially into the top of a conical-shaped cyclone, or centrifuge, on each stream bank. The water swirls to the bottom of the cyclone and slowly rises in a chamber inside the cyclone, then flows out of a horizontal pipe in the chamber top to a buffer tank. This provides flooded suction to a set of high-lift pumps in the pump station alongside, to pump from there to the Manguzi or Enkanyezi WTPs.

An electrically operated solenoid valve on the cyclone scour is automatically opened for a second or two at regular intervals to flush any settled organic matter back into the stream, downstream of the abstraction point. The buffer tank can also scour into this drainage pipe when required (Photo 1).

The water quality from these perennial streams is generally good as they flow slowly through mostly indigenous vegetation in soft sandy soils. The treatment process after cycloning is flocculation, sedimentation, disinfection and filtration.

Another raw water source is the natural Shengeza Lake which forms part of the Greater St Lucia Wetland Park. Water is abstracted from the lake via a suction main comprising about 8 m of 150 m dia GMS pipe and 72 m of 180 mm dia stub-flanged HDPe PN16 pipe.

From the pump station at the lake’s edge the suction main is buried below the lake shore over a distance of about 45 m. It then runs for another 35 m into the lake where it emerges through the lake floor, under the water, and runs 200 mm above the floor on concrete mooring blocks spaced at 3 m centres. The main terminates in a removable stainless steel intake screen positioned approximately 300 mm above the lake floor, and 1.5 m below lake water level. The intake screen is especially designed to allow both the intake of water and the return of water during flushing of the main.

Roughly 7 m from the pump station, along the suction main, is a non-return valve (NRV), situated between two short pipes, with inlet ports in a concrete chamber, which had to be sunk almost 2 m into the saturated lake shore, along with the main, by high-pressure water jetting.

Before the duty or standby pump starts in the pump station (see Photo 2), a solenoid valve allows water from the delivery main back around the pumps into the suction main between the pumps and the NRV to prime the pumps. The duty pump then starts with the solenoid valve remaining open for a few minutes to ensure full priming. After the pump stops, another solenoid valve opens and allows water from the delivery main back around the pumps into the suction main between the NRV and the lake to flush the main for a few seconds.

When the next pump cycle starts, using the alternative pump through a flip-flop switch to balance pumping hours for each pump, the process repeats itself.

No sooner had this system been installed in the lake and tested, when a family of curious hippos took up residence near the inlet screen, probably being attracted by the sound or vibration, but thankfully so far not appearing to have damaged anything. Hopefully hippos are as careful where they place their feet as elephants!

Due to indigenous vegetation, algae, wave action from onshore winds and the presence of hippos, the lake water is often very turbid. The positive displacement abstraction pumps are especially designed for the lake’s pumping conditions and raw water quality, and pump in a single lift from the lake directly to the Manguzi WTP (Photo 3) about 6 km away.
At the WTP, flocculant is added to the water, and it then runs through a dissolved air flotation (DAF) unit where air under pressure is injected into the water. The scum then floats to the surface and is skimmed off with brushes drawn over the unit by nylon chains. The water then passes through a rapid gravity filter and is disinfected before entering the final water reservoir.

The Franklin Wells for the World Foundation was also involved in the scheme by part-funding the small water supply project at Inkosi Tembe’s traditional homestead at Emfihlweni, where treated borehole water is reticulated from elevated storage to the homestead, two schools, a mobile clinic point and the local community.

**CHALLENGES AND RISKS**
The main challenges and risks/threats to this scheme are as follows:
- The current capacity of the WSA to effectively O&M the scheme with sufficient resources and funds.
- The scattered settlement patterns of the benefiting communities, resulting in a high per capita cost, with the potential of making the scheme unsustainable in the long-term, unless a cost-recovery plan is implemented.
- The vulnerability of all reticulation mains not being easily identifiable or ‘protected’ within registered servitudes, resulting in their ease of access for potential vandalism or illegal connections.
- The current capacity of Eskom’s electrical supply to the area. Frequent outages, planned or otherwise, are currently experienced, and frequent fluctuations in the voltages of the three incoming phases are also often experienced. This should hopefully improve when/if the line is extended south to Mbazwana, forming a link back to Eskom’s network.
- The large number of illegal water and electricity connections in the area.
- Illegal water connections are often made off dedicated pumping and gravity mains, from which no connections must be made, thereby affecting flows to critical destinations.
Illegal connections are normally cheaper than legal ones but are generally sub-standard, resulting in numerous leaks. There are indications that some locals ran small businesses selling water prior to the commissioning of this scheme. The scheme now affects their livelihood, resulting in acts of vandalism to infrastructure to maintain their income.

- Illegal electrical connections (mostly by someone who appears to know exactly how to tap into the supply) are numerous and often very dangerous. These are normally off only one phase at a supply point, which can lead to phase imbalance and resultant damage to pumping plant. Eskom has contracted a specialist team to remove illegal connections, but for various reasons it is very difficult to prosecute offenders, so this vexing problem continues unabated.

- Numerous incidents of vandalism and theft, leading to additional security costs being incurred. The provision of sets of keyed-alike padlocks for all valve and meter chambers, structures and buildings cost in excess of R400 000!

- There were also various incidents of hijackings or attempted hijackings directed at the project team, due to the close proximity of the scheme to Mozambique.

- The vulnerability of the groundwater aquifer, due to population densification, the development of Manguzi as a growth point, the planting of gum plantations as a source of income, pollution, etc.

- The generally flat topography, consisting of small undulating vegetated coastal dunes, required elevated storage at virtually all storage points, and also required a very large amount of air and scour valves to properly vent and scour the system along these undulations.

J&G considered various systems for abstracting water from the two streams and the lake. These systems had to be able to deal with often turbid water with hard or soft solids in suspension of varying shapes and sizes. They had to be low maintenance due to their remote locations, with as many visible components as possible (as opposed to a buried sand abstraction system at the lake), making the identification of problem areas or faulty components easier – especially in the presence of hippos in the lake!

SCHEME COSTS

The total cost of the Kwangwanase and Enkanyezini rural scheme is R164 688 920. Of this amount, R26 636 590 (16.2%) covers the indirect costs of consultants, implementing agents and the community. A total of R138 052 330 (83.8%) covers the direct costs of construction by contractors, sub-contractors, learnerships, etc. Franklin Wells for the World Foundation donated an additional approximately R260 000 towards a small stand-alone section of the scheme, bringing the total scheme cost to almost R165 million.

CONCLUSION

With all its various facets, this rural scheme has, over the last eight years, been very interesting and challenging, both technically and socially. Most of the challenges mentioned above can be expected on any rural project in South Africa. The ultimate aim of the scheme is to provide safe, potable water to consumers, which will contribute towards an improvement in their quality of life. Hopefully this has been achieved, and it will now depend on the WSA, the benefiting community and other relevant role-players to take full ownership and responsibility for the scheme to ensure sustainability for their mutual benefit.
The effect of densification on water and sewer networks

The question many local authorities have, is what the effect of proposed densification would be on the existing engineering infrastructure? The simple answer is that densification has an adverse effect on infrastructure, as the utilisation of capacity is increased. But the question remains how negative this is, as opposed to the benefits that densification could offer. The City of Cape Town recently commissioned a study to determine the effect of densification on water-related services. Through GLS’s involvement in the study, as well the company’s other experiences of master planning of water and sewer networks throughout South Africa, some light can be shed on this issue.

BACKGROUND TO THE CITY OF CAPE TOWN STUDY
Urban densities in the City of Cape Town (CCT) have declined from 1904 through to 2000 even while its population had been rapidly growing. The urban density has, during this period, decreased from 115 persons per hectare to 39 persons per hectare, while the population increased from 265 000 to 3 000 000. If Cape Town had continued to consume land at a rate of 115 persons per hectare (the rate at which it was consuming land in the early 1900s), it would only occupy a footprint of 260 km² in contrast to the 774 km² that it does today. This affects the ability to retain land for agricultural use, and for scenic and natural biodiversity purposes.

The challenge is to restructure urban settlements so that they are compact, make efficient use of land, are easy to move around in with a clear transport hierarchy, and do not unnecessarily consume peripheral agricultural and rural land.

Increasing densities help to achieve a more sustainable level of development, meet housing targets using less land, and improve the viability and efficiency of amenities and infrastructure services. Currently most South African settlements have an average density of about 12 dwelling units per hectare (du/ha). The aim of densification is to raise these low densities to a level of 25 du/ha in order to increase the overall efficiency and environmental quality of urban settlements.

METHODOLOGY OF STUDY
The methodology for the CCT study was the following:

■ Three independent pilot areas were identified as possible densification areas.
■ A planning scenario for each area was developed by the City’s planners.
■ A capacity analysis on the existing networks for each scenario was performed by means of hydraulic modelling.
■ Reinforcements to the existing networks, required to accommodate the higher densities, were identified.
■ Comparisons between the costs of the three scenarios were drawn in order to determine the most suitable area for densification.

RESULTS OF THE STUDY
The results of the CCT study are the following:

■ The unit cost for upgrading the water network beyond the boundaries of the densification area varied between R1 300/du and R5 100/du (excluding VAT) for the three pilot areas.
■ The unit cost for upgrading the sewer network beyond the boundaries of
the densification area varied between R900/du and R3 200/du (excluding VAT) for the three pilot areas. The highest cost of R5 100/du for the water network upgrading was mainly due to a new storage reservoir, which was required, while the highest cost of R3 200/du for the sewer network upgrading was mainly due to reinforcements to the bulk outfall sewer, which were required in the particular densification area.

CONCLUSIONS OF THE STUDY

The general conclusions of the CCT study are the following:

■ The costs of new water and sewer services are highly dependent on the availability of bulk infrastructure with sufficient spare capacity. Although this study only investigated ‘brownfields’ developments, this should even be more relevant for ‘greenfields’ developments.

■ To adequately investigate the feasibility of densification, the status and impacts on the water and sewer services cannot be assessed in isolation. The status and impacts on the other services like roads, stormwater and electricity should also be addressed.

■ The availability of an adequate potable water source and sufficient electricity source is a prerequisite for sustainable densification.

■ It is seldom, if ever, the case that the water and sewer networks are the determining factors for future densification. These networks can normally be engineered (at a cost which is nominal relative to the total project cost) to acceptable design standards. The factors that would more likely play a substantial role are the planning issues, i.e. environmental issues, political issues, aesthetical issues, possible changing of the character of the suburb, supply and demand forces in the property market, etc.

BROADER RAMIFICATIONS OF DENSIFICATION

The conclusions of the broader impacts of densification on water and sewer networks are as follows:

■ It is the generally accepted view that higher population densities over a smaller land area, as opposed to lower densities over a greater land area, lower the cost of providing public services. This is because shorter distances need to be traversed and because of savings derived from economies of scale.

■ The degree to which an area is either under- or over-capacitated is relevant to the issue of density and cost effectiveness. If infrastructure in an area has spare capacity, it will be more cost effective to develop that area as opposed to others, but only until infrastructure investment is required to accommodate any further/additional development.

■ Infrastructure costs vary with location, according to local land use and environmental conditions. The locations where adverse conditions exist are largely unrelated to distance from the central areas. In fact, the intensely built-up nature of the more central areas (CBD) often makes it relatively more expensive to install additional engineering services.

■ A change of land use from residential to business, or vice versa, could create capacity in networks, as the peak water demands and corresponding sewer flows are out of phase – see Figure 1 with sewer hydrograph indicating residential peaks typically around 07h00 and 19h00, while business has a more evenly spread water demand and associated sewer flow with a peak roughly at 11h00.

■ Densification would normally require higher fire-fighting requirements, which are likely to impact on the water supply to the area.

■ Densification by reducing green areas could have a larger effect on sewer flows than water demands. Where single residential stands are subdivided (or granny flats are added) the garden area is reduced, with associated reduction in irrigation...
demands, while the population of the stand is increased with an associated increase in sewer flows.

RECOMMENDATIONS
While assessing the feasibility of densification in a given urban area, the following should be focused upon:
■ A similar study whereby the cost implications of each of the required infrastructure components are determined for a particular area should be performed.
■ The so called ‘big five’ infrastructure components, i.e. water, sewer, stormwater, roads (including traffic study and parking requirements) and electricity, should all be considered.
■ The bulk infrastructure threshold for each of the ‘big five’ services should be determined. This threshold is the point which is reached where all the existing spare capacity is taken up and at which point the service is therefore utilised optimally. By assessing the thresholds of each of the five services a density threshold for the area can be decided on. This threshold will then be the density limit after which substantial bulk infrastructure investment will be required in the case of a further increase in density – see infrastructure threshold curve in Figure 2.
■ By calculating the unit costs for each density scenario, and performing a sensitivity analysis by increasing or decreasing the density, the impacts of the services costs on the entire project can be assessed.
■ Not only infrastructure issues, but also planning issues, i.e. environmental issues, political issues, aesthetical issues, possible changing of the character of the suburb, socio economic issues, property market forces, etc, should be addressed in the process of assessing the feasibility of densification in a particular area.

ACKNOWLEDGEMENT
The author would like to acknowledge the City of Cape Town for their consent to publish the selected contents of the said densification study.

The challenge is to restructure urban settlements so that they are compact, make efficient use of land, are easy to move around in with a clear transport hierarchy, and do not unnecessarily consume peripheral agricultural and rural land. Increasing densities help to achieve a more sustainable level of development, meet housing targets using less land, and improve the viability and efficiency of amenities and infrastructure services.
Dealing with the rural sanitation backlog in the Chris Hani District Municipality - a case study

THE CHALLENGE
How does a Water Services Authority (WSA) serving a population of some 800,000 residents, comprising about 220,000 households in an area of nearly 37,000 square kilometres in 14 formal towns and several hundred rural villages, determine the magnitude (quantity and distribution) of the backlog in rural sanitation; then draft appropriate tenders (all within the necessary ecological, technical, financial and legal constraints and guidelines) and award contracts to deal with the backlog?

To complicate matters further, some villages are known by different names or the same name is used in different areas.

And, most importantly, how can this be made sustainable so that sanitation facilities do not have to be replaced once the pits are full, or if the on-going administration and cost of dealing with the faecal sludge in the full pits has to be provided for?

A CASE STUDY - CHRIS HANI DISTRICT MUNICIPALITY
This case study shows one way of dealing with the rural sanitation backlog – essentially applying two basic principles:

■ Moveable top structures
■ No payment for materials on site; payment for completed structures only

This was done by the Chris Hani District Municipality (CHDM) in the Eastern Cape Province, one of 44 district municipalities in South Africa (see map).

The CHDM serves as the Water Services Authority for eight local municipalities. It is constitutionally obliged to progressively
provide free basic water and sanitation services to indigent people or families within its jurisdiction.

**FREE BASIC RURAL SANITATION SERVICE**
The emphasis on the term ‘free basic service’ is on basic. For example, for electricity it means a monthly allocation of a mere 50 kWh for a family, while the guideline for water is 6 Kl per household per month within 200 m of homes. Basic sanitation options, in turn, depend on the location and the density of dwellings. For the CHDM the selected basic rural sanitation unit is the Ventilated Improved Pit-latrine (VIP).

**ELEMENTS OF BACKLOG TO BE DEALT WITH**
After establishing the quantum of the rural sanitation backlog – numbers of families and positions of relevant villages – four contracts had to be managed by a coordinator within the CHDM (as expanded upon in the following sections) as follows:
1. Groundwater Protocol
2. Institutional and Social Development (ISD)
3. Implementation
4. Administration
A coordinator was appointed to integrate and manage all of the above, including convening meetings between the parties to facilitate the smooth implementation of the programme.

**GROUNDWATER PROTOCOL**
The Groundwater Protocol (GWP), carried out by geo-hydrologists, essentially provides a tool to ensure the protection of groundwater so that it is not polluted, by VIPs in particular. This is essential since many of the rural villages are dependent on groundwater for their domestic water supply. This process is independent of the other three contracts. It is area-based and not dependent on the actual locations of the villages.

It used existing boreholes and other information to determine which villages (or portions of villages) were suitable for the installation of VIPs and those which are not. This could be due to, inter alia, a high water table or the presence of dykes and sills which could be conduits for the transmission of polluted water down to the water table.

The geo-hydrologists also trained implementers, administrators and ISD practitioners on how to deal with rural sanitation provision in sensitive areas subject to potential pollution of the groundwater.

**Determining the backlog**
The rural sanitation backlog was defined as the number of families without basic sanitation. It thus did not include:
- families with existing basic sanitation at or above the given standard, provided by previous programmes
- families being provided with basic sanitation by contracts current at the time
- families to be served by tenders about to be advertised at the time

It was generally known that in the CHDM the rural sanitation backlog occurred in the eastern local municipalities (Ngcobo, Intsika Yethu, Emalahleni, Sakhisizwe, Inkwanca and Lukhanji), which formed part of the former Transkei homeland. The exact size of the backlog was not known – nor where it occurred.

In the CHDM the backlog was determined by their internal ISD facilitators through a base-line study. The study had to record:
- the names and number of families in all the various villages with sub-standard rural sanitation
- wheelchair users (not people with disabilities generally)
- previously supplied VIPs now full – Archloos, VIPs with fixed top structure, etc
- allocated sites with no buildings.

**INSTITUTIONAL AND SOCIAL DEVELOPMENT (ISD)**
For the base-line study, ISD practitioners recorded the above-mentioned data.
It was found that about 100 000 families in 194 rural villages in five local municipalities lacked basic sanitation, and about 10% of these families had wheelchair users.

During implementation, ISD practitioners linked contractors with the people in villages, where appropriate, to:
- deal with any issues arising as a result of the contract
- inform villagers of the imminent arrival of a contractor
- be involved with the selection of local labour
- interact with families to indicate where their VIP is to be placed on their plot.
They also provided hygiene education – especially hand-washing after use of toilet – and afterwards followed up during the maintenance period.

**IMPLEMENTATION**
Appointing advisors, contractors and administrators
In a conventional client-consultant-contractor contract the consultant carries out the design and administers the contract on behalf of the client, where the client has neither the knowledge nor the qualified, experienced human resources to do so. In this instance the CHDM knew exactly what was required, but did not
have the human resources to do so. They therefore acquired support in the form of technical assistance from two independent advisors to carry out the following:

- the compilation of pre-qualification tender documents
- determining which tenderers pre-qualified
- management of the construction and evaluation of demonstration toilets by short-listed consortia (see "Priced tenders" below)
- recommendations for award of the tenders.

This was done to ensure that potential bidders/consortium partners would not be involved with, or compromised in, the project setup process.

In the past different service providers had different approaches and designs to deal with rural sanitation, resulting in a plethora of top structures and volumes of pits – and poor administration. Since the CHDM knew exactly what they required, the appointment of two appropriately experienced ‘one-man’ consultants provided the assistance they needed to deal with these challenges. In the past there had been instances where consultants based their fees on the large value of the contracts rather than on the time spent on a basic – but complex – design of a VIP, repeated many times.

It further required the appointment of administrators to carry out the quality control and certification of work done (See ADMINISTRATION below).

Four areas of operations
It was considered that a single contract for the complete backlog would be beyond the capacity of any one consortium and hence four approximately equal areas were delineated.

The tender documents were exactly the same except for the location of the backlog areas.

Allowance was, however, made for tenderers to tender on any two or more areas if they considered they had the capacity to complete such work. In such instances they had to provide proof of their ability to undertake the work.

Names of villages
The fact that some villages were known by different names or the same name was used in different areas posed a problem. This was solved by the client’s GIS section listing the co-ordinates of villages, together with the different known names.

Tender documents
Moveable top structures
The client stated that the tender specification was to be based on the top structures being movable, to enable them to be relocated to new pits when the original pits were full. The philosophy is that there would be no handling of faecal sludge. The CHDM may still have to deal with faecal sludge in many of the sanitation facilities which had been constructed with fixed top structures before the present contract – a problem they mostly inherited from the (old) Department of Water Affairs and Forestry (DWAF).

No payment for materials on site
The client also had the foresight to insist on a further essential but unusual clause of the tender document – that no payment would be made for materials on site. Previously ‘supply only’ contracts ensured the spending of budgets, but caused untold problems related to the client’s responsibility to safeguard such items against theft, deterioration and breakages. The client also had to ensure supplied items were actually used by contractors subsequently appointed.

CIDB grading
A regulation which posed a challenge was one by the Construction Industry Development Board (CIDB) which essentially states that the value of the contract determines the CIDB grading of contractors to which contracts can be awarded. The grading is determined by the complexity, size and value of contracts completed.

In this instance the individual tasks are not very onerous: essentially it is to supply and distribute acceptable top structures, then dig a pit and put the slab and top structure on it – but it must be done many tens of thousands of times over vast areas at very big total contract values. The CIDB regulation applies to contracts which essentially involve construction. On the other hand, supply contracts have to meet different criteria, and in this case the supplier also organised the installation of the product.

This meant that a supplier’s business had to include an implementation arm, or suppliers and contractors had to form consortia to be able to tender.

Elements of VIPs
Essentially a Ventilated Improved Pit-latrine (VIP) consists of three elements:

- Pit
- Slab
- Top structure

Four areas of operations
It was considered that a single contract for the complete backlog would be beyond the capacity of any one consortium and hence four approximately equal areas were delineated.
The pit volume determines how long it will last before it is full – the bigger the longer it will last. This also depends on the number of users. The CHDM adopted the DWAF pit size guideline of 3 m³ – plus 500 mm freeboard. A ring beam to stabilise the top edge of the pit also had to be provided.

**Minimum requirements**
Rather than specifying particular designs for the slab and top structure, minimum requirements were developed for all elements – top structure size, doors, hinges, pedestals, etc. This was to enable consortia to determine whether their existing products were compliant or whether they wished to amend them to comply with the specification. The minimum requirements are listed in Appendix A.

**Pre-qualification**
The pre-qualification tender did not require any price to be submitted. It would be evaluated purely on a technical basis. Short-listed tenderers would be invited to submit priced documents. This is similar to the two-envelope system which is sometimes used. The point allocation for meeting specified criteria was clearly stated, noting that only tenderers scoring 60 or more points would be shortlisted. Pre-qualified tenderers would be requested to construct demonstration toilets.

**Factory**
It was stated that it would be an advantage if tenderers intended establishing a factory in the CHDM.

**Four tenders**
The tender document indicated that the work to be done would be broken into four different areas of the CHDM and those pre-qualifying would be free to tender for one or more areas.

**Wheelchair users and distribution of material**
Tenderers also had to indicate the type of top structure they would provide for wheelchair users and how material would be transported to the various villages and within the villages to the homesteads. This involved an intimate knowledge of the access roads from the factory to the villages. Logistics became an essential part of the supply and construction process.

**Ground conditions in which pits had to be dug**
Tenderers were also required to state their method for dealing with:
- Rock, sand and clay
- High water table

**Pre-qualification tenders**
A pre-qualification tender was advertised, based on the requirements stated above. A total of 42 tenders were received and assessed. Only six of these pre-qualified. The main reasons some tenders did not qualify related to:
- no local factory proposed, or only very limited elements (like doors) being manufactured locally
- vague, ambiguous or unrealistic commitments made about engaging local enterprise in transport of components
- proposed use of conservancy tanks
- data submitted for only some members of the consortium
- no financial data presented about the significant start-up capital required to survive the start-up period
- inadequate programmes provided
- low scores for the Preferential Procurement Policy Framework Act (PPPFA) points.

**Priced tenders**
The six shortlisted tenderers were then invited to submit priced tenders. While these were being assessed, each of these consortia was allocated a place to construct demonstration toilets. These were all at schools and could be used on completion. The CHDM paid for all such usable demonstration units, regardless of whether or not the tenders were successful.

Each consortium had to construct two toilets to demonstrate
- a normal toilet
- a top structure for wheelchair users
- how they would deal with providing a sanitation facility where rock outcropped at the surface.

The demonstration toilet exercise proved to be most informative to both the consortia and the CHDM. It is easy to state on paper how a process will be executed, and in this instance there were very few, if any, projects which assessors could refer to in order to assess performance. The requirement that demonstration toilets be erected enabled the professionalism and experience of consortia in supplying and erecting the demonstration units to be assessed relative to their written submissions. One consortium withdrew their tender once they experienced the practical difficulties involved – particularly the requirement of 500 mm free-board above a 3 m³ pit volume.

The top structures of demonstration toilets had to be dismantled and re-erected on the same pits to assess their movability.
The prices of consortia for the four different areas, or a combination of areas, were also analysed. One supplier/installer scored the highest points for all four regions and was awarded all four tenders in the total sum of R784 million to be constructed over a three-year period.

They also tendered to erect a factory in Queenstown for the manufacture of the top structure and slab units.

The contracts are scheduled for completion by the beginning of 2014.

**ADMINISTRATION**

During the construction of public projects (e.g. RDP houses) suitably qualified and experienced administrators had to be appointed to carry out quality control and to certify payment of work done. If such projects fail due to poor workmanship, it is a reflection on the contractors, the client and the administrators. It is a critical element in the successful execution of projects. Where the ‘site’ is located over a vast area, this element becomes even more important.

If consultants had been appointed to draw up tender documents, the client would normally have appointed them to administer the contract regarding quality control and certification of work done. In this case such administrators had to be appointed separately to carry out these two functions.

They faced a formidable task with a site located over a vast area, and quality control having to be carried out on thousands of small, individual structures. In fact, while only one supplier/installer was appointed, the task of administering the contract is so large that four administrators had to be appointed – one for each of the original four areas – to be able to provide sufficient field personnel for quality control and certification.

Each VIP site had to be visited several times to check on, at least, the position, the pit, the slab, the top structure, and the final inspection for certification of payment.

The administrators with their team of field workers also had to have detailed knowledge about access roads from Queenstown to the numerous villages, since payment for administration was based on a price per unit certified complete.

**LESSONS LEARNT**

Attention to the following items will benefit future projects:

1. The Groundwater Protocol can be and should be carried out well ahead of any other contracts. Such information must then be included in tender documents, thereby making it available to tenderers so as to inform them of the number of alternate basic sanitation solutions which would be required.

2. Before the project commences, policy must be developed, work-shopped and accepted by the WSA council regarding the following:
   - Who will dig the second and subsequent pits when the initial pits are full – households or the WSA or a clearly defined combination?
   - Who will move the top structures and slabs (with ring beams) – households or the WSA or a clearly defined combination?
   - Households to carry out daily and routine maintenance, as well as keeping the sanitation facility clean, both inside and outside.

   When councillors develop such policy, with input from the technical, financial and social departments, the cost implications of such policy needs to be accepted. Councillors must fulfil their duty of communicating this to the recipients.

3. To carry out the baseline survey, the ISD practitioners need knowledge of:
   - Council policy as stated above
   - The contract period – so that hopes of immediate action are not raised (three-year contract in this case)
   - Groundwater protocol results – so that villagers where VIPs are not possible can be forewarned

4. ISD practitioners must also record GPS coordinates of households.

5. It should be a requirement for demonstration toilets to move the slabs on which the top structures are to be re-erected to assess the viability of the full operation.

**NOTE**

The author takes full responsibility for any of the views expressed in this article.
Top structure - technical specifications

The top structure must have the following:

1. A room which
   1.1 is able to be dismantled
   1.2 is able to be moved without damage from factory to homesteads in specific villages
   1.3 is able to be re-assembled on its original slab
   1.4 is able to be easily dismantled, relocated and re-assembled at least three times after initial erection – or a monolithic structure able to be moved monolithically
   1.5 is waterproof and essentially dark inside but allows air to flow easily through it
   1.6 has minimum inside dimensions of 900 mm width by 1 100 mm length by 1 950 mm height

2. A roof which
   2.1 is secured against wind damage
   2.2 has overhangs which will keep the room waterproof
   2.3 drains away from the door

3. A pedestal with
   3.1 a robust body which is easily cleaned
   3.2 a robust seat and seat cover

4. A door which
   4.1 has a minimum clear opening of 800 mm width by at least 2 000 mm height
   4.2 has a frame securely fixed to the walls or, alternately, an arrangement where no door frame is required
   4.3 is able to be locked from the outside with a padlock
   4.4 is able to be opened from the inside even if locked on the outside
   4.5 slams closed and secures itself when a person pushes it from the outside without holding down the door handle
   4.6 slams closed and secures itself under the action of wind if left open
   4.7 has hinges able to withstand the maximum impact forces during a lifespan of 50 years when the door is slammed closed by the wind or people
   4.8 has hinges able to withstand, during a lifespan of 50 years, the impact forces at its maximum opening position experienced from the door being blown open or thrown open
   4.9 requires minimum painting, if any
   4.10 has a minimum of 50 mm and a maximum of 100 mm air space above or below the door

5. A vent pipe which
   5.1 has a minimum 100 mm internal diameter
   5.2 extends through the slab to a minimum of 500 mm above the highest outside point of the roof
   5.3 is UV resistant
   5.4 is securely fixed at vulnerable points
   5.5 has a durable nylon fly screen with maximum 1.5 mm openings, securely fixed to its top

6. Slabs which
   6.1 can accommodate different pit configurations varying from different diameters to different rectangular pits
   6.2 are pre-cast

From the word: GO
we chose the right colour

L13, L18, L22 Terrafix Terracrete 4x4 Multi L11, L12, L15, L16

Find a supplier near you at www.terrafource.com / Tel: 021 465 1907

APPENDIX A

Top structure for wheelchair users - technical specifications

The top structure must meet all of the above except that top structures for wheelchair users must have:

8. A room which has minimum inside dimensions of 1 700 mm width by 1 800 mm length by 1 950 mm height

9. A door which
   9.1 has a minimum clear opening of 800 mm width by at least 2 000 mm height
   9.2 opens outwards completely so that the clear opening is not obstructed by the thickness of the door

10. Grabrails as detailed

11. A ramp with a maximum slope of 1:12, at least 1.2 m wide
The new wastewater treatment plant currently under construction outside Swakopmund is that municipality’s most ambitious engineering project to date. The urgent need for this facility to go live presented daunting challenges to all involved, including a tight deadline and very little margin for error. Maintaining municipal infrastructure and the expected level of service that the public demands is no easy feat, especially when the expansion of a municipality puts a severe strain on that very same infrastructure. When the site for the existing Swakopmund sewage treatment plant was chosen in 1957, it was considered the most appropriate, in part because it was located far away enough from the town boundaries, and therefore posed very little risk in terms of annoyance or inconvenience to the town’s inhabitants. However, the staggering development of Namibia’s premier holiday destination in the intervening years has seen the town’s boundaries creep nearer and eventually surround and then extend far beyond the confines of the existing plant.

Two problems arose as a result: firstly, demand has matched the capacity of the plant, and while the plant remains static, the population of Swakopmund keeps growing. Secondly, residents were increasingly complaining about unpleasant odours and ongoing problems with flies. The plant was upgraded in 2000, which somewhat ameliorated these complaints. However, it did not take long before the same issues were experienced again, and in September 2007 the Swakopmund Town Council’s Tender Board awarded a tender for the design and development of a new sewage treatment plant to Windhoek Consulting Engineers. A tender for the construction of this new plant was advertised in 2010 and awarded to Botes & Kennedy Civils (Namibia). Construction on the new plant began on 17 January 2011, and the project is slated for completion on 14 December 2012.

According to Mr Eckart Demasius, CEO of the Swakopmund Municipality,
NISSAN LCV RANGE.
MAKES PERFECT BUSINESS SENSE.

The Nissan Light Commercial Vehicle (LCV) Range will help you take your business to new heights. Designed for any size of business, the Nissan LCV Range offers you reliability, durability and affordability – key building blocks to ensure the success of any business. The Nissan LCV Range will be with you every kilometre of the way.

Nissan. Innovation that excites.

For more information on the Nissan LCV Range visit www.nissan.co.za
there was absolutely no room for error on this project. “Ideally Swakopmund should have had a new sewage plant two years ago, but that wasn’t possible and we’ve been operating on the edge capacity-wise with the current sewage works till now. During the holiday season at the end of every year Swakopmund experiences a massive influx of people. It is said that the town’s population doubles in this time, and while I don’t think it’s quite that dramatic, the surge in numbers tests our infrastructure – especially that of our sewage system – to the absolute limit. Given the fact that the current wastewater treatment plant is well within the city limits, we cannot afford to have it pack up on us. Hence, we need a new plant with (much) bigger capacity and that’s why the deadline for 14 December is non-negotiable. Testing still needs to be done on the biological part of the plant, and the new plant needs to be phased in, initially piggy-backing on the existing one. We estimate that this will take three months, but it’s absolutely critical that we get the process going as soon as possible. Ultimately we intend for the plant to be operating by February 2013, or March at the very latest.”

Another factor that demanded that the project be kept within a strict budget and time frame was that, remarkably, the Swakopmund Municipality was financing the total N$167 million project itself, without any assistance from banks or the government or burdening the public. Says Demasius, “It’s unusual for a municipality to be able to finance a project of this magnitude itself, and in all honesty it’s unlikely – given today’s rocketing building costs – that something like this will happen again in Namibia. However, given that we were forking this money out, the technology used needed to be right, the budget and time frame had to be adhered to strictly, and the engineering and construction had to be first class. I’m pleased to say that to date this has all turned out to be the case, and speaking as a qualified engineer myself, the concrete work done by Botes & Kennedy Civils on this project was some of the best I’ve seen yet.”

The new municipal wastewater plant proved to be a banner project for Botes & Kennedy Civils (Namibia) as one of the largest projects that the company
has worked on to date. This is in fact a once-in-a-lifetime project in Namibia, as a sewage plant of this scale is not built that often (the site measures 168 m x 339 m). The project necessitated close collaboration with numerous subcontractors, and overcoming stumbling blocks such as encountering rock at shallow depths, a shortage of skilled labour and a temporary shortage of reinforcing steel, which set the project back by three months. However, these challenges were overcome and the project is well on track. Another contributing factor to the successful progress of the project was the use of advanced construction techniques, including specialised formwork systems and the pumping of concrete.

ACHIEVING A FIT IN TERMS OF LOCATION AND TECHNOLOGY

Preparations for the selection of a site for the new wastewater treatment plant in early 2008 encompassed community involvement, a detailed environmental impact assessment (EIA) scoping report, as well as a geological assessment to determine the soundness of the founding conditions.

During the course of the EIA four potential sites were identified. These sites all fitted into the long-term development plan for Swakopmund (the planning horizon for this project was 2022), and fell behind a natural barrier, namely the Henties Bay by-pass road. No major obstacles were found to any of the sites, but certain issues did crop up: there was a potential stormwater drainage problem at two of the sites; a potential bird threat to air traffic at one site and to a lesser degree at another; and while all sites were favourable in southwest wind conditions, all failed in terms of east wind conditions. Two sites had a lot of rocky material, while another had a base of rock covered by much softer material.

Comparisons were made between the four sites using a number of criteria:

- The types of systems required by the individual sites (in order to get raw sewage to the treatment plant, and purified effluent from the plant to town)
- The infrastructure expenditure required for each site, in terms of the different pumping stations, pump sizes, pipeline lengths and motors needed
- The energy required for each site (based on the current tariff)
- The estimated running costs of each site (capital costs were reduced to monthly costs over a 20-year period at 12% per annum).

Once the criteria had been assessed, appropriately weighted according to impact and then matched, the site ultimately chosen – on balance – ticked all the right boxes.

Three different wastewater treatment technologies were considered, namely a Trickling Filter Process, an Extended Aeration Biological Nutrient Removal (BNR) activated sludge process, and a Membrane Bioreactor (MBR) activated sludge process. The three technologies were compared according to a number of criteria, including proven and reliable technology, discharge quality, robust treatment technology, plant operations, plant...
through various stages, namely the inlet works, the primary distribution box, the biological nutrient reactor, the secondary distribution box, the final clarifiers 1 and 2, the sludge mixing box, the sludge thickener, digesters 1 and 2, the sludge drying beds, the sand filter, and the chlorine contact channel.

5. Once the water has been processed, it will enter the treated water distribution network, which will make it available for use in gardens and parks throughout the municipal area.

TEAMWORK: THE ESSENTIAL COMPONENT

Considering the technical complexity and scale of the project, it is remarkable that the average age of the management team from Botes & Kennedy Civils (Namibia) was 35 years and younger. The success of the project can undoubtedly be attributed to the mix between the ambition of the younger management and the invaluable experience of the more senior supervisors. Working on this project has been an enormously fulfilling experience – staff have not only been individually challenged from a professional point of view, but also had to pull together and commit to the project to make it a success. It has been a collaboration and team effort in every sense: if something went wrong, it was everyone’s problem; if something went well, it was to everyone’s credit.
The project also saw the company navigating new management territory. Until the start of this project Botes & Kennedy Civils (Namibia) essentially had a number of teams working on different sites. That is, each team had their own leadership, hierarchies and ways of doing things. The construction of the sewage plant, however, required the manpower and expertise of all these teams on one site, necessitating the integration of the senior management from these teams in order for them to work together efficiently towards the common objective. The integration went off without a hitch, and
after having worked many long hours and weekends, the combined team is now in
the home stretch on this project.

CONSIDERING THE LONG TERM
Projecting the future growth of the municipal area is not an exact science,
especially given the myriad factors involved. However, should Swakopmund’s
growth continue at the current rate, it is conceivable that in time the town
will begin to encroach on the new plant. However, certain ‘buffers’ have been
put in place to ensure the continued viability of the plant. Firstly, there is
a long-term plan for Swakopmund’s development in place – this means
that development is methodical rather than haphazard, and that the plant’s
existence and location will be taken into account. Secondly, its location on
the other side of a natural barrier will also assist in keeping the area purpose-
specific (that is, you’re not likely to have a suburb spring up next door overnight).
And thirdly, a 500 m barrier (exclusion zone) is planned around the site,
thereby avoiding or at least mitigating any future plant/resident conflict.

CONCLUSION
Teamwork, cooperation and a responsibility towards the community, as well as
the need to be especially prudent with the community’s funds, meant that this
project was challenging to all those involved. However, proper planning, col-
laboration and sound management have resulted in an engineering feat that is
likely to be recognised as a noteworthy achievement.

Number crunching
This project necessitated:
• 11 000 m³ of concrete
• 1300 tonnes of reinforcing steel
• 24 000 m² of formwork
• 19.8 km of 400 mm Class 10 HDPE pipeline

Employment, job creation and training
• At peak 225 employees were active on the site; 60% of those were under
35 years of age, many of them women.
• Botes & Kennedy Civils (Namibia) trained a number of unskilled labourers in
carpentry, bricklaying, steelfixing and pipelaying. Many of these were women.
The company endeavours to accommodate as many of these labourers in
upcoming projects as possible.

Professional team
Client
Swakopmund Municipality
Main consultants
Windhoek Consulting Engineers, Golder & Associates
Main contractor
Botes & Kennedy Civils (Namibia)
THE PROJECT CAPTURES good practices at smaller municipalities that have been selected specifically for their Green Drop results. This is then followed by a workshop where the selected municipality shares its critical success factors, good practices and challenges on the road to Green Drop status.

In 2011, the first two workshops were held at the Bitou and Tlokwe Local Municipalities. The workshops were so successful that the sponsors decided to showcase more municipalities on their way to Green Drop status in 2012, with a focus on risk abatement. Two more municipalities were selected from the Green Drop audit, namely Buffalo City MM in the Eastern Cape and Drakenstein LM in the Western Cape.

The discussions at these workshops revealed how important it was for municipalities to be actively involved in the risk assessment process, which is integral to developing their Wastewater Risk Abatement Plan ($W_{2}$RAP). It was also evident that municipalities need support to develop their $W_{2}$RAPs in-house.

Since the Free State is currently at the bottom of the Green Drop performance ladder, this province was selected to pilot a groundbreaking process for $W_{2}$RAP development, with the support of SAICE. The officials in the Free State office of the Department of Water Affairs were enthusiastic partners in the process, and took responsibility for the logistics under the competent leadership of Busiswa Bele. DWA Water Services Regulation, the Green Drop Help Desk and the Free State Rapid Response Unit added further value to the workshop by providing hands-on assistance to the participating municipalities.

Six local municipalities (Naledi LM, Phumelela LM, Mantsopa LM, Dihlabeng LM, Tokologo LM and Ngwathe LM) were recently invited to Bloemfontein to attend a full-day technical workshop on 28 August to develop Phase I of their $W_{2}$RAP. The 16 delegates arrived, ready for the day, with laptops and the information and data they were required to bring along: design information of their plants; process flow diagrams; effluent quality and flow data of the past month; details of the process control, management and maintenance teams; as well as relevant photos.

SETTING THE GOAL
Zanele Mupiriwa of the DWA head office set the goal, namely to bring the...
Cumulative Risk Rating (CRR) of the Free State down to 40%. "We look forward to seeing improvement in your position. With commitment and the groundwork that you will be covering today, plus the support of Busiswa and her team, you can do it!” she assured the delegates from the various municipalities.

She pointed out that W2RAP is a key requirement in the Green Water Services Audit for 2012/13 and makes up 15% of the overall Green Drop score. This is more than many Free State municipalities’ overall score on the last Green Drop assessment! Currently, only four Free State municipalities have developed W2RAPs (but the SAICE workshop changed that status!).

Dr Marlene van der Merwe-Botha facilitated the workshop with her trade-mark panache and enthusiasm. A W2RAP framework document has been prepared for each municipality, already populated with baseline data for each wastewater system, as available from the Green Drop report. As an introduction, Marlene took the delegates through the three phases to develop a W2RAP, explaining the concept of Cumulative Risk Rating (CRR) and the data that makes up the score.

Each municipality then had the opportunity to analyse the Cumulative Risk Rating of each of their plants. Many delegates were surprised to learn how much the lack of information contributed to high risk ratings. They learned that if they did not know their plant’s design capacity, and did not measure flows, they would not know if they were exceeding the capacity risk of a plant.

Gerald Molley of DWA Regulation gives tips to the team from Mantsopa LM on how to use the Green Drop system.

Delegates at the Free State W2RAP workshop, August 2012.
COMPLIANCE: THE ULTIMATE PROOF OF SUCCESS

Compliance is regarded as the ultimate proof of success. It was stressed during the workshop that, "If you don’t monitor your effluent, you have zero compliance and it automatically puts you in the highest risk category. But, you can go back and start monitoring regularly at critical control points and get yourself out of the red,” was the positive message.

Marlene took the delegates step-by-step through the process to reduce their ‘inherent’ risk rating for 2013 towards a measurable ‘residual’ risk. At each step, delegates entered the data that they brought along in the supporting Excel spreadsheets. Charts were automatically created that they could insert into their W2RAP draft.

Gerald Molley, from DWA Regulation, illustrated common mistakes that are made when municipalities enter their information on the Green Drop system. He explained, for example, how a wastewater treatment plant could be incorrectly classified, and why a process controller’s registration could be declined. These mistakes have serious implications for their Green Drop scores and he showed how they could be corrected easily.

After these work sessions the participating municipalities walked away with Phase I of their W2RAPs completed. Phase II, which is a detailed risk assessment of each aspect of each plant, will be completed on site. In the final Phase, they will have to interpret all the information, highlight critical risk areas and develop and implement a mitigating plan to decrease these risks.

Finally, participants were reminded that a W2RAP is a living document which calls for revisiting every few months to record new risks and mitigating measures. Only if the W2RAP is applied on a continuous basis and is updated regularly, will it add real value to ensure that the effluent that municipalities release into our rivers and our environment is safe.

FOR MORE INFORMATION PLEASE CONTACT
Willie Potgieter
on behalf of SAICE
willie@enhancegroup.co.za
These planning requirements are then linked with legislated budget and expenditure requirements. All these requirements are critical and are fully justified from a control and provincial/national reporting perspective. In many cases, however, councillors and officials see these requirements as just another box that has to be ticked to satisfy the ‘authorities’ and little regard is paid to the real benefit that can be obtained from properly integrating and utilising these planning elements.

This article proposes a practical planning process that utilises the legislated requirements, while at the same time encouraging a more structured internal approach within a municipality. This Integrated Planning Process will also assist municipalities to produce more effective budgets and to be in a position to effectively spend its money in a structured and planned manner.

THE INTEGRATED PLANNING PROCESS

A municipality is required to produce a whole series of planning documents and mechanisms including the following:

- Spatial Development Framework (SDF)
- Integrated Development Plan (IDP)
- Medium Term Expenditure Framework (MTEF)
- Annual Budget

This process of planning is designed to create a multi-layered approach that balances a series of plans ranging from long-term to short-term. The long-term plans...
masters of construction

Esorfranki Pipelines offers construction and rehabilitation of onshore pipelines for the gas and petrochemical, water, stormwater and sewerage sectors. Esorfranki Pipelines is a specialist in laying and welding steel pipelines in South Africa.

QUALITY IS OUR FOUNDATION

30 Activia Road Activia Park Germiston South Africa  t: +27 11 822 3906  f: +27 11 822 2036  www.esorfranki.co.za
are necessary to ensure that what happens currently supports the likely needs of future development and growth of the municipality. This would include the early acquisition or protection of land for future social and community needs, as well as the planning of long lead time items such as water and sewage treatment works, electricity sub-stations, major roads and other substantial developments. The shorter-term plans would then be dealing with the implementation of the items identified in the long-term plan, as and when they are required. The principles are equally applicable to all the municipal service delivery areas inclusive of housing, community facilities and municipal facilities.

SPATIAL DEVELOPMENT FRAMEWORK (SDF)

Although part of the IDP, the SDF should be seen as the first level of planning due to its over-arching approach and the long-term nature of its purpose. While the IDP will be updated on an annual basis (and this will be discussed further below) the SDF would normally only be reviewed on a three to five year basis. It must also be accepted that the 25-year time scale of the SDF means that it must be flexible and be able to be adjusted to accommodate changes in longer-term policy where these are justified.

The SDF then becomes the overall developmental master plan of the municipality, as well as setting down the planning and development guidelines and controls that are to be applied. Ideally the SDF will also estimate the timescale for likely development, and this will then inform the need for the future development of bulk services, as well as the need for future schools, clinics, municipal facilities, etc.

Linked to the SDF, the municipality should also have long-term services and facilities master plans that show the extent of any likely service or facility development within a 25-year time frame. This master plan is generally in the form of an electronic geographic information system (GIS) that will show the location and details of existing facilities and services, as well as how future facilities and services would be accommodated. The use of this master planning approach ensures that adequate provision is being made for future developments that may occur. These plans should each be regularly updated to remain consistent with the latest version of the SDF.

A critical element of the SDF is transportation planning, and of particular importance in this regard is the need to ensure that adequate land is reserved in current developments for future planned transportation corridors and transfer facilities. The simple case of this is to allow adequate width in road reserves for future upgrading and widening to serve longer-term development. It may, however, be necessary to also plan for rapid transport systems, taxi ranks and inter-modal transfer facilities. It is far wiser to allow for this at the early stage rather than to have to go through an expensive expropriation process later.

INTEGRATED DEVELOPMENT PLAN (IDP)

The principle of the IDP is that it is intended to be for the term of the municipal council, i.e. five years. It is, however, required that the IDP be reviewed annually. It should be looking at the future assets that are needed to serve the area based on the likely development that will take place. It will primarily inform the capital budget of the municipality, but will also have an impact on the operational budget due to the need to make allowance for increased maintenance and repair costs as the asset base grows, as well as the increased personnel requirements caused by any growth in customers and communities to be served.

The municipality can be using this plan either in a reactive or a proactive manner. The reactive approach will be based on what development is planned to take place by external parties and this will then dictate where future services and facilities will be required. The proactive approach is where the municipality takes a view on where it would like to see development happening and promotes this development through the advance provision of infrastructure. Obviously the proactive case must be carefully structured to only be applied to areas where it will be attractive for external parties to develop. In most cases there will be a mixture of reactive and proactive development.

The importance of the IDP with the five-year time frame is that most major projects require a multi-year plan to achieve implementation. For complicated projects such as water and sewage treatment plants, redevelopment projects, etc, the combination of land acquisition, environmental and licence approvals and a possible two to three year construction period can mean that it could take five years or more to achieve completion.

With the natural growth in any municipality, the value of the asset register will grow each year. It is also likely that the number of households and municipal customers will grow each year. These factors, combined with service delivery backlogs being addressed and, hopefully, the advancement of the socio-economic status of the municipality’s residents, will mean that the expectations on the municipality will increase. All of this has to be factored into the municipality’s budgets and the various plans...
When the natural growth in any municipality, the value of the asset register will grow each year. It is also likely that the number of households and municipal customers will grow each year. These factors, combined with service delivery backlogs being addressed and, hopefully, the advancement of the socio-economic status of the municipality’s residents, will mean that the expectations on the municipality will increase. All of this has to be factored into the municipality’s budgets and the various plans. These are the types of factors that have to be dealt with in a properly thought out Integrated Development Plan.

**MEDIUM-TERM EXPENDITURE FRAMEWORK (MTEF)**

The MTEF planning relates to the municipal budgeting process of forecasting for the next financial year plus the following two years. By this stage in the process there should already be clarity on the capital budget requirements and, providing the necessary advance arrangements, designs and tender documents have been put in place, there can be a good level of confidence in the ability of the authority to effectively spend the allocated funds in the given time scales. Checks should be made that projects allowed for in the budget for the second and third years of the MTEF have been already planned and designed, and that any obstacles that have to be dealt with are addressed in the preceding years.

It is, however, not only capital budgets that have to be addressed in the MTEF. It is also important to be thinking ahead and identifying the other impacts of what is happening in the municipality that may affect future budgets. As discussed elsewhere, the impact of the natural growth in the municipality and its customer base have to be factored in. In addition to allowing for inflation, realistic estimates have to be made of the effect of growth on both the income and expenditure levels. What other factors will impact, what attempts are being made to increase income (tighter control of debtors, property and meter audits, new valuations, etc) and what attempts are being made to control expenditure (improved efficiencies, outsourcing, reduction of electricity and water losses, etc)?

**ANNUAL BUDGET**

As the capital budget should have been pre-determined through the medium- and long-term planning processes dealt with above, the main focus of the Annual Budget will be on the specific strategies covered by the operating budget. It is, however, recommended that the budget should be supported by an Annual Business Plan. This plan would also incorporate the Service Delivery Budget Implementation Plan (SDBIP). This would be prepared by each of the operating divisions of the municipality and then combined into a single municipal plan. By writing down the needs and requirements for the year, it forces everyone to think through the budget rather than blindly applying a set increase from the previous year’s figures. It will also form the basis of the ultimate justification to go to Council to support the budget proposals. This plan is the justification and explanation for the budget.

Ideally the Business Plan should be compiled first as this will provide the basis for creating a budget that is relevant to the real requirements of the particular service.
CONNS MANUFACTURING Co (Pty) Ltd, a privately owned water filtration company in Cape Town, specialises in primary sand and disc filtration for agriculture and industry.

From the required flow rate (m³/hr), CONNS will design, manufacture, assemble and ship skid-mounted modular plug and play filterbank units.

CONNS supplies single Simplex Standalone units, Duplex units or Multiple Modular Filterbanks according to customer’s filtration requirements.

Using the CONN 500 ton hydraulic press, domes of various sizes in mild steel, are deep drawn and pressed out to form tank bodies for a wide range of CONNS products:

- CONNS Sandfilters, CONNS Activated Carbon Tanks and CONNS Fertilizer Application Tanks.

Also manufactured are a range of CONNS Discfilters and Meshfilters.

CONNS Filters are widely used throughout Southern Africa as primary filtration for:

1. Agriculture on Drip, Microjet, and Sprinkler Irrigation Systems.
2. Factory / Mine Water Filtration – Direct or Side Stream.
3. Drinking Water Filtration for Farms, Households, Small Towns and Municipalities.

For over 45 years years, CONNS has supplied the Southern African market with basic robust water filtration equipment and has built up a good name for quality, service and reliability.

As with the budget, however, the Business Plan has to be realistic and remain in line with the projected income or funding that will be available. The budget should, as far as is possible, be based on realistic estimates of what has been identified in the Business Plan as opposed to an escalated amount that was allocated last year. Critical items in the budget should be calculated from first principles each year, often known as “zero-based budgeting”, to ensure that realistic amounts are allowed for.

The budget should reflect the interventions that are proposed for that year and should also factor in required changes in staff, costs that are increasing at above the rate of inflation, e.g. electricity costs, and increasing requirements for maintenance and repairs. As with all budgets, there will be negotiations that have to take place to obtain a final, approved, balanced budget, but by having written justifications through a Business Plan will make the matter easier to argue and defend, as well as clearly setting out the implications if such expenditure is not incurred.

**Determining user charges**

Another important element of the Annual Business Plan is to determine the user charges that are necessary to cover the costs of each service or facility. Like the budget itself these charges should be calculated every year based on the best estimates that are available at that stage (typically six to eight months ahead of the start of the financial year). Estimates will not only have to be made of the operating costs, but also of the level of use of the service or facility, as well as estimates of any subsidies that will be allocated.

A final budget will always be subject to negotiations, as the initial requirements for expenditure will generally exceed the projected income. As the budget figures are adjusted, so too must the Business Plan be adjusted until the final Plan is a description of how the final budget will be implemented.

**CONCLUSION**

Planning and the writing of plans are often considered an additional burden on the already busy lives of municipal officials. Much of the work described above is, however, already a requirement in the municipal environment. With a little bit of extra effort and commitment these documents can be transformed from being something that has to be done into something that should be done, both for the benefit of the communities that are being served, and to better focus and structure the work of the municipal councillors and officials.
INTRODUCTION
Recent asset management legislation has holistically incorporated a host of previously stand-alone principles such as "life cycle cost analysis" and "remaining useful life". Some of the issues responsible for the rapidly deteriorating condition of municipal road networks are the lack of capacity, skilled resources and funding to efficiently and effectively manage road networks. Other contributory factors are the lack of reliable condition data and proper Pavement Management Systems (PMS) to budget for and optimise expenditure of available maintenance funds. eThekwi Metropolitan Municipality has, for almost a decade now, used its PMS to achieve arguably one of the best paved metropolitan road networks in the country.

eThekwi’s PMS Division is managed by a small complement of professionals, while technical support is provided by Aurecon. The PMS is organisationally located within the Pavement and Geotechnical Engineering Branch of the Roads Provision Department. It is the primary source of all road-related information within the municipality, assisting various entities as shown in Figure 1.

PAVEMENT MANAGEMENT AT eTHEKWINI
The Roads Provision Department implemented a PMS in 2003, commonly known as the eROADS (eThekwi Road Optimisation Analysis Decision Support) system. eROADS is underpinned by an asset management software application dTIMSTM CT provided by Deighton Associates Limited of Canada and configured for use in strategic analysis of pavement networks by Aurecon. The eROADS system is capable of the following broadly defined functions:
- Ensures accurate and reliable location referencing of road data.
- Provides easy access to accurate road network inventory information.

Figure 1: Relationship between the PMS Division and other entities
■ Regularly quantifies and reports on the condition of the road network on a network, sub-network and road segment level basis (historic trends and current status quo).
■ Allows for integration with the Geographic Information System for presentation of data.
■ Provides a basis for allocating funds among different sub-networks through life cycle costing and optimisation.
■ Assists in the selection of viable alternative maintenance strategies for each road section in the network and determines life cycle effects of these in terms of: future network conditions, future maintenance requirements and budgetary needs, future road network rehabilitation backlogs, and future asset values of the road network.
■ Assists in the selection of the best preventive maintenance and rehabilitation strategies for each road section while taking into account imposed budgetary and resource constraints, now and in the future.
■ Assists in identifying the budgetary requirements for implementing the ideal preventive maintenance and rehabilitation strategy for each road section, now and in the future.
■ dTIMS™ CT ensures that decision support is available at Level 4 to 5 in terms of the classification of the decision support levels shown in Table 1. Decision support at lower levels will not be sufficient to manage the maintenance of the extensive eThekwini pavement network effectively. Specifically, Life Cycle Cost Analysis (LCCA) and optimisation of investments under constraints are the tools required for effective pavement management.

Table 1 Classification of decision support levels for Pavement Management Systems (Robertson 2004)

<table>
<thead>
<tr>
<th>Decision support level</th>
<th>Dominant characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic asset data, rule-based work allocation</td>
</tr>
<tr>
<td>2</td>
<td>Project and network level assessment, geographic reference</td>
</tr>
<tr>
<td>3</td>
<td>Life cycle cost analysis of agency impacts</td>
</tr>
<tr>
<td>4</td>
<td>Life cycle cost analysis of agency and user impacts, economic prioritisation</td>
</tr>
<tr>
<td>5</td>
<td>Optimum investments within constraints, sensitivity analysis</td>
</tr>
<tr>
<td>6</td>
<td>Economic, social, environmental multi-criteria assessment, risk analysis</td>
</tr>
</tbody>
</table>

Table 2 Surveyed road network length by surface type (2011)

<table>
<thead>
<tr>
<th>2011 Survey data</th>
<th>Pavement type</th>
<th>eThekwini length (km)</th>
<th>SANRAL &amp; KZN length (km)</th>
<th>Total length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block</td>
<td>57</td>
<td>0</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>143</td>
<td>70</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>Flexible</td>
<td>6 046</td>
<td>1 365</td>
<td>7 411</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TOTAL (km)</td>
<td>6 252</td>
<td>1 435</td>
<td>7 687</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Functional road classification

<table>
<thead>
<tr>
<th>Functional category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA</td>
<td>Trunk roads, primary distributors, freeways, major arterials and by-passes used for primary urban distribution and linking urban districts/sectors</td>
</tr>
<tr>
<td>UB</td>
<td>District and local distributors, minor arterials and collectors, industrial and CBD roads, goods loading areas and bus routes used for district distribution and to link communities</td>
</tr>
<tr>
<td>UC</td>
<td>Urban access collectors used for local distribution and to link neighbourhoods</td>
</tr>
<tr>
<td>UD</td>
<td>Local access roads (residential): loops, access ways, access courts, access strips and cul-de-sacs</td>
</tr>
</tbody>
</table>

Figure 2: Training of visual condition assessors and assistants

eTHEKWINI’S ROAD NETWORK
The paved road network within the eThekwini Municipality consists of roads belonging to the municipality, SANRAL, the KwaZulu-Natal Provincial Department of Transport, as well as private entities such as Transnet and private residential developments. The extent of the network surveyed in 2011 is shown in Table 2.

Since implementation of the PMS the eThekwini road network is classified based on a functional hierarchy as described in Table 3.

The majority of the paved road network (49%) consists of UD roads that provide mobility and access in a local residential context. UA roads make up only 1% of the network while UB and UC roads constitute 27% and 23% of the road network respectively.

VISUAL ASSESSMENTS
A fundamental aspect of the PMS is the network level visual condition inspections done every two years in accordance with well-defined standards based on the TMH9: 1992 and Draft UTG12: 1996 visual condition assessment standards. The eThekwini standards cater for flexible road pavements, jointed...
Ductile Iron Manhole Covers & Frames

- Stronger than Cast Iron
- Up to 50% Weight Saving
- New Specification
- Cost Effective

Value, Performance & Quality

Inland Branches:
- Bloemfontein: Tel: 051 408 9200
- Bloemfontein: Tel: 051 408 9200
- Burslief: Tel: 011 722 4466
- Lephalale: Tel: 015 322 0800
- Secunda: Tel: 017 631 4200

Coastal Branches:
- Durban: Tel: 031 716 2200
- East London: Tel: 043 736 6022
- Port Elizabeth: Tel: 041 404 1600

Inledon
The most trusted name in quality products & brands
www.inledon.co.za

Inledon
The most trusted name in quality products & brands
www.inledon.co.za
concrete pavements, segmented block pavements, and non-standard or unclassified pavements, while the SANRAL Manual M3-1 (1998) is used for visual assessment of continuously reinforced concrete pavements.

Paved roads are segmented into smaller segments of 500 m which are rated in terms of the various distresses occurring on them. The degree (seriousness) and extent (occurrence) of each distress are recorded. The distresses include surfacing defects, structural defects and functional aspects.

Since its inception in 2003, the PMS has embraced the principles of capacity building and skills transfer by training and accrediting in excess of one hundred visual condition assessors and assistants from the private sector. To date, the selection of survey teams has been based on an Expression of Interest, followed by a pre-tender training, calibration and testing session with specific, defined criteria for acceptance of staff offered as assessors and assistants. This happens together with continuous follow-up and recalibrations, as needed from the quality control part of the Quality Management Plan (QMP) for visual condition assessments. The quality acceptance procedure is based on re-assessment of a random 10% of the road network of each assessment team to confirm the quality of the production condition assessments. This forms the quality acceptance part of the QMP. The QMP ensures that only acceptable data is imported to the PMS for analysis.

The road network is divided into a number of inspection areas, depending on the number of appointed teams (each team consisting of two people, i.e. an approved assessor, and a driver (the assistant). Typically 15 teams are used, and progress per team per day is approximately 10 to 15 km.

Visual condition assessments are captured on the road on tablet notebooks in pre-prepared forms using the Mobicap software. At the start of the segment the form for the relevant visual assessment segment is displayed on confirmation from the assessor that his location as shown on the GIS map on the tablet, from the linked GPS, is correct, as well as the road type. This ensures data capturing against the correct segment. The forms also contain all possible validation procedures during and at the finalisation stage of data capturing of each individual segment’s visual data. The purpose is to achieve complete and cross-checked data per visual segment before the assessor physically leaves the relevant segment.

Capturing the visual assessment data directly on the tablets also provides an additional advantage: assessment teams are monitored weekly regarding progress as they submit the data to a central repository. Weekly and cumulative progress per team is available in tabular format and spatially on the GIS. This allows contingency plans to be made should a team default on the required progress.

The network level visual inspections were conducted successfully by trained assessors on the paved road network in 2003, 2005, 2007, 2009 and 2011.

**PROCESSING OF VISUAL CONDITION DATA**

The surfacing, structural and functional distresses recorded are used to calculate a composite Visual Condition Index (VCI) for each paved road segment (TRH 22 1994: 125-126). The VCI is a percentage index ranging between 0 and 100, where 0 represents a road segment in very poor condition and 100 represents a
Murray & Roberts Construction, newly created by merging Murray & Roberts Construction and Concor, is one of the largest players in the African, Middle East and South East Asian construction sectors. The company offers a range of engineering and contracting services that include civil, building and marine construction, roadworks, earthworks, engineering and opencast mining.
road segment in very good condition. It is generally accepted that the condition of a road deteriorates with time as shown in Figure 4. The figure also shows the categorisation of the VCI in five condition categories.

**PERFORMANCE TARGETS FOR PAVED NETWORK**

In order to ensure that the municipal road network delivers an acceptable level of service, the following performance targets have been set (the PMS is ideally suited to determine the future budget needs for achieving and maintaining the performance targets through its LCCA component):

- No roads in any of the UA to UD categories may deteriorate below a VCI of 30.
- No UA and UB roads may deteriorate below a VCI of 50.
- Less than 10% of UC and UD roads may deteriorate below a VCI of 50.
- The average VCI of the entire network must remain greater than 70.

Since 2003 the average condition of eThekwini’s surfaced roads fluctuated between 76% and 80% (See Figure 5).

The condition distribution in 2011 is shown in Figure 6. Note that less than 5% of the network is in the very poor and poor condition categories, indicating a healthy situation compared to the internationally accepted maximum of 10% which is also recommended by RISFSA (2005).

The paved road network is probably eThekwini’s most expensive asset. Maintaining it in a good condition is vitally important to the city’s economic growth, quality of life and its overall sustainability.

**THE PMS AS A STRATEGIC PLANNING TOOL**

In an environment of decreasing budgets and increasing demands, the PMS has proved to be an invaluable strategic tool, used to make cost-effective decisions on pavement management issues. The eROADS system optimises the information from the network level surveys taking into account pavement condition, predicted deterioration and treatment costs to produce a prioritised list of rehabilitation and seal projects across the entire municipal network, such that the most economically viable treatment is undertaken, given the budgetary constraints for road maintenance. The optimisation process is therefore not a simple “worst first” scenario, but evaluates the merits of a range of possible treatments, each time taking into account the predicted future deterioration of the road in accordance with the HDM-4 World Bank Road Deterioration models. This iterative process is undertaken for every road in the municipal network to produce a multi-year Maintenance and Rehabilitation (M&R) programme.

Based on the strategic level maintenance needs analysis, the Roads Provision Department has successfully
influenced Council to increase its funding allocation for pavement preservation and rehabilitation.

The 2007 Strategic Maintenance Needs Analysis indicated a funding level need of approximately R300 million for preventive maintenance and rehabilitation to counter further deterioration and to improve the condition of the network. The municipality subsequently increased the preventive maintenance and rehabilitation funding level from R80 million to more than R300 million for 2008/9. This investment resulted in an increase in the overall condition of the network from 2007 to 2009, due to increased portions of

![Figure 8: Predicted condition five and ten years from 2011 versus annual funding level](image)

![Figure 9: The eThekwini road network](image)

**Legend**

- National roads
- Provincial roads
- eThekwini Roads
  - Very poor
  - Poor
  - Fair
  - Good
  - Very good
roads in the “good” to “very good” condition categories (Figure 7). The Strategic Maintenance Needs Analysis of 2009 predicted an improvement in the overall network condition if the Medium-Term Expenditure Framework (MTEF) budget (R424 million) was allocated for preventive maintenance and rehabilitation according to the recommendations of the LCCA. The national bitumen shortage and contractor procurement issues were some of the pitfalls resulting in the recommendations not being fulfilled, hence a slight decrease in the condition in 2011. However, based on the Strategic Maintenance Needs Analysis of 2011, the Roads Provision Department has implemented an intensive re-seal programme to prevent “fair” roads deteriorating into the “poor” condition category. Roads in a “fair” condition have the opportunity to be preserved with cost-effective preventive intervention measures, effectively increasing the life of the pavement by many years. This informed decision-making process would not have been possible without the PMS and its decision support tools.

The strategic analysis is used to determine the consequences of various policy and budget scenarios, and can be expressed as the expected average future condition, expected future backlog (roads in poor and very poor condition), expected condition distribution, etc. Figure 8 shows the expected impact of annual budget levels on the future average condition five and ten years into the future.

PAVEMENT MANAGEMENT IN THE ASSET MANAGEMENT CONTEXT

The PMS is strategically positioned to satisfy National Treasury’s regulatory requirements of Generally Recognised Accounting Practice (GRAP) from a road asset management perspective. The PMS provides the information needed of the municipality’s asset management system regarding the relevant characteristics of the pavement asset, and their condition and remaining useful lives. The PMS, however, contains substantially more detailed information without which the strategic needs analysis and preparation of multi-year preventive maintenance and rehabilitation plans would not be possible. Currently, the PMS satisfies the decision support needs of the pavement managers of eThekwini, while the information passed on to the asset management system satisfies the accounting requirements. The latter alone is not sufficient for pavement management and satisfies a different need.

PMS AND GIS INTEGRATION

The implementation of the PMS has led to substantial requirements being put on Corporate GIS regarding the spatial integrity of the road centerline map. The PMS uses the dynamic segmentation (also known as linear referencing) capabilities of the GIS to display data and information from the PMS for the linear pavement infrastructure. This requires specific topology rules to be adhered to in the GIS regarding direction of lines, overshoots, undershoots, duplication, etc. To assist Corporate GIS in complying with this, Aurecon developed an Editing Verification Tool (EVT) as a plug-in to verify any changes made to the spatial network, e.g. addition of new roads, splitting of links, etc. The road network identifier information of every link (start and end descriptions, nodes, km positions) is also generated from the GIS, thus ensuring a fully synchronised GIS and PMS.

CONCLUSION

The success of eThekwini’s PMS can be attributed to the interaction of three fundamental components: processes, people and technology. eThekwini has developed a pavement management mindset, having implemented processes that are geared towards managing the road network at optimal levels. The professionals responsible for the PMS ensure that sufficient budgets are motivated for data collection, system upgrades, skills development and operational support. Adhering to strict quality management procedures for data collection ensures that the strategic analysis of the consequences of budget and policy scenarios is based on sound data. This leads to the development of optimum multi-year preventive maintenance and rehabilitation plans, the implementation of which has had positive effects on the overall pavement conditions. In the long term, eThekwini’s R46.8 billion road pavement asset is in good hands!

NOTE

The list of references is available from the editor.
SANRAL tackles poverty and unemployment in the OR Tambo District Municipality

INTRODUCTION

SANRAL’s core business is to provide and maintain national roads, and to promote economic and social development. It also recognises that it has an obligation to support broader community development initiatives. These initiatives are aimed at creating access and mobility in rural areas in the following ways:

- Poverty relief through short-term employment opportunities
- Human development through skills transfer and training
- Job creation and community participation in labour-intensive construction
- Having a positive impact on rural communities
- Long-term sustainability by enhancing potential economic growth and development
- Development of SMMEs.

PROJECT IDENTIFICATION

In 2006 SANRAL (South African National Roads Agency Limited) invited the various local municipalities within the OR Tambo District (former Transkei) to submit requests for community development projects. This area has one of the largest concentrations of poverty in South Africa, with some 70 – 80% of households earning less than R1 500 per month, and of these between 35 and 50% have no income at all. The following conditions were set as minimum criteria:

- The project must be identified by the local municipality and must be recognised in their Integrated Development Plan.
- The project must be confined to roads and related infrastructure.
- The project must target the poorest of the poor.
- The local municipality must demonstrate that they will provide funding to maintain the assets once the project has been completed.

In 2010, after conducting a broad assessment of the critical shortcomings in the area, and after screening...
the requests and consulting with the respective local municipalities, SANRAL rolled out the following four community development projects:

- Embhobhenni Access Road, Mbizana Local Municipality (4.0 km)
- Mpophomeni Access Road, Port St John’s Municipality (8.8 km)
- Matheko River to Msikaba AA Access Road, Ingquza Hill Municipality (12 km)
- Ingquza Hill to Mangwaneni Access Road, Ingquza Hill Municipality (10.5 km)

**EXPECTED OUTPUTS**

These projects were expected to generate:

- Short-term employment opportunities for the mainly local residents, particularly for women and young people.
- Opportunities for local materials suppliers, small plant owners (tractor, trailer, water car, etc) to be employed as sub-contractors on site.
- Labour-based construction techniques in line with the government’s Community-based Public Works Programme (CBPWP).
- Skills development through training of local residents in road construction techniques.
- The provision of needed road infrastructure.

**THE CONSTRUCTION PROJECTS**

These four projects focused mainly on the construction and upgrading of rural gravel access roads (in some instances even track roads) to surfaced standards in areas where access was a problem both for local and public transport, resulting in residents having to walk long distances to reach the main roads.

The projects comprised both conventional and labour-based methods of construction. This included construction management, mentorship, coaching and a CETA accredited training programme, employment of local labour, and plant and materials suppliers (SMMEs) from within the respective municipal areas where possible.

At the inception stage, close interaction between the Ward Councillors, Traditional Authorities, Municipal Labour Desk Officers and the various community stakeholders took place, which initiated the establishment of the Project Liaison Committee (PLC) to deal
with community issues and the sourcing of labour. A Project Liaison Officer (PLO) was also appointed from within the community [the article on page 70 of this edition elaborates on that aspect].

CONSTRUCTION MANAGEMENT SERVICES
Through SANRAL’s procurement process the following Construction Managers were appointed for the four projects:
■ Inkanyiso Consulting for the Mpophomeni and Ingquza Hill Access roads
■ LSA School of Technology for the Embhobheni and Mathoko Access Roads.
The main role of the Construction Manager was to manage and supervise the overall project, like a contractor would. The Construction Manager acted as a contracts manager who procured all plant, fuel material and labour directly from the suppliers without any middleman.

All designs, documentations and drawings were developed on site. The road was aligned according to the existing conditions (footprint) in the village and followed the natural topography. All drainage problems were identified, and positions determined and designed on site.

After the assessment of site and design, the Construction Manager prepared a Bill of Quantities with no mark-up or profit, and this then became the shadow price against which the work was targeted, measured and paid.

EMPLOYMENT OPPORTUNITIES
Due to the nature and length of the roads, these projects sometimes spread over several wards. The PLC was responsible for sourcing and providing a fair representation of local labour from each ward. Equal employment opportunities were provided for women, youth and the disabled. At the start of construction, the numbers of people involved were limited, as they were still undergoing training, but as construction progressed, more people were employed simultaneously. At peak performance each site had approximately 200 people employed on

Selected activities were identified to be executed by task work using labour-intensive methods of construction. This is work that is normally done by machines. Each task was prepared in advance and the teams were required to complete the tasks (either individually or in groups) within the day. All task work was based on the Department of Labour’s minimum wage rate. Task work was concentrated on selected pavement layers, emulsion-treated base layers, seal work for low volume roads, shoulder construction, drainage, etc.

TAL now offers a full range of construction adhesives and chemicals and provides quality construction solutions from concept to completion.

With our 40-year track record in tiling and construction adhesives, we are proud to announce the addition of X-CALIBUR Construction Chemistry to our range. The X-CALIBUR range consists of product systems designed to protect concrete structures from environmental hazards, prevent decay and repair damage. X-CALIBUR products have been utilized during the construction of many of the world’s prestigious buildings and structures such as the soaring Burj Khalifa in Dubai, Ferrari World in Abu Dhabi, and the Stonecutters Bridge in Hong Kong.

TAL is an ISO 9001:2008 accredited company and is dedicated to developing quality construction chemical products that are compatible with the harsh South African climate and in line with the latest technology.

Our highly qualified technical advisers will visit your site and draw up a detailed materials and methods specification for your specific requirement.

For more information contact the TAL Technical Advice Centre on 0860 000 TAL(825), or email taltech@norcrossa.com

www.tal.co.za / www.xcalibur.co.za

Johannesburg: 011 206 5730  Cape Town: 021 386 1810  Durban: 031 579 2263

X-CALIBUR is manufactured in South Africa by TAL—a division of Norcross SA (Pty) Ltd under licence from X-CALIBUR International

TAL is a registered trademark of Norcross SA (Pty) Ltd.  X-CALIBUR is a registered trademark of X-CALIBUR International

The images contained in this advert are intended as graphic devices only and in no way infer that the X-Calibur products have been used to repair or protect these structures.
site. On average approximately 140 to 170 people were employed over the duration of the projects, a period of between 14 and 18 months. Of these, between 42% and 47% were women, and between 70% and 75% were young people. In addition each site had two disabled persons employed. Approximately 35% of the construction cost was paid towards labour, which was a direct injection into the respective communities.

SMME ENGAGEMENT OPPORTUNITIES

Business opportunities were offered to local material suppliers, while plant hire contracts were signed with local plant owners/operators, i.e. single tractor and trailer operators. In some instances where an operator's plant experienced a breakdown, financial assistance was provided to allow the operator to get back on his feet again and provide a service. Large plant like dozers, back-actors, graders, compaction rollers, tipper trucks, etc, were sourced from surrounding areas, as these were not readily available locally. Where small plant or equipment broke down, local welders and mechanics would be called in for repairs. On the Mpophomeni site an NQF Level 2 learner, who was mechanically inclined, repaired the concrete mixers whenever they became inoperable. Apart from doing his normal tasks, he was also on standby for emergency repairs. Where major overhaul problems were encountered, these were done after hours to earn an additional income. SMME-generated income is estimated to be between 18% and 30% of the construction costs.

TASK WORK AND PRODUCTION

Selected activities were identified to be executed by task work using labour-intensive methods of construction. This is work that is normally done by machines. Each task was prepared in advance and the teams were required to complete the tasks (either individually or in groups) within the day. All task work was based on the Department of Labour's minimum wage rate. Task work was concentrated on selected pavement layers, emulsion-treated base layers, seal work for low volume roads, shoulder construction, drainage, etc.

Training test sections were carried out for each activity to develop a Method Statement, and to then determine the rate of production that can be achieved in a day. This exercise was performed
over several days (minimum five days) to achieve the required end product specifications and quality standards. Table 1 (on page 64) reflects the labour-intensive construction production rates achieved for the Mpohomeni and Ingquza Hill sites.

TRAINING
Training was mainly targeted at the local youth (younger than 35 years) who were in possession of a Senior Certificate. They were identified to undergo the NQF Level 2 Construction Road Workers, and NQF Level 4 Construction Supervision training programmes. Preference was given to learners who had passed Mathematics and Physical Science. Approximately 120 learners per project were assessed to determine their competencies. Each selected learner was registered with the Construction CETA and upon completion, received an accredited certificate for the completed Unit Standards. In total approximately 60 learners completed the NQF Level 4 Supervision of Construction Processes full learnership training programme, and 180 learners completed 60 credits of the NQF Level 2 Construction Road Workers skills programme.

In addition 360 people from the community were given practical on-site training in the following courses:
- Plastering
- Plumbing
- Block-laying
- Carpentry
- Catering
- Office Practice
- Receptionist/Telephonist
- Understanding Business Principles
- Starting your Business
- Managing your Business
- Marketing your Business
- Planning your Business Strategy
- Growing your Business

Approximately R9.2 million was spent on training over these four projects.

IMPACT ASSESSMENT / POSITIVE OUTCOMES
- Dust-free roads which are contributing positively to a healthy and clean environment.
- A public transport facility that is easily accessible and allows locals to be collected and dropped off closer to their homes.
- The improved road condition makes it possible for businesses to deliver goods in the villages. This has also encouraged mobile vendors to do business in the community.
- The concrete footway up the mountain gives locals access to the hospital from the valley below.
- There has been visible evidence of improvements to surrounding dwellings where roofs have been replaced, galvanized water tanks repaired, homes renovated and even extended, modern furniture delivered, cell phones upgraded, etc.
- All personnel working on the projects were required to open bank accounts. Monthly wages were deposited directly into their bank accounts. Training was given on the operation and use of ATMs. Assistance was offered and applications made for those persons who were not with a solid track record spanning over half a century, GIBB has established itself as a partner of choice. Backed by a Level 2 BBBEE rating, GIBB provides engineering solutions to a diverse range of markets across the African continent.
in possession of South African Identification Documents (IDs).

- Skills and experience gained during training and construction provide a window of opportunity for further development and possible work opportunities.

**PROJECT COSTS**

Since 2010 SANRAL has invested approximately R138 million in these four OR Tambo District projects. The costs have been made up as follows:

- Construction 104.7 million 75.8%
- Construction Management 24.1 million 17.5%
- Training 9.2 million 6.7%

**CHALLENGES ENCOUNTERED**

- In rural areas, good quality material is very often scarce and often not available close to the project. Extensive geotechnical investigations should therefore be carried out to determine all the potential material sources. In addition, adequate consultation with the relevant authorities must take place and be recorded. Materials obtained from other wards often result in conflict, with the possibility of communities sabotaging a project and halting progress if they are not benefiting.

- Plant and equipment are not readily available in the rural areas and often have to be brought in from outside. Local prices are also often over-inflated as owners presume that their plant and equipment will get preference. It was therefore sometimes cheaper to hire in plant from outside.

- Another minor problem was the initial resistance to task work. Labour often complained that the task was not achievable. However, once the teams became more organised and had identified each member’s strengths and weaknesses, they began coordinating their activities such that their tasks were completed on time, sometimes even before time. They eventually realised the benefit of task work, so this problem was resolved.

- Small plant breaking down was a frustration as the teams could not complete their tasks. The Construction Manager had to make sure that sufficient spares were available to service the breakdown, and a mechanic was on standby to attend to breakdowns.

**PROJECT STATUS**

At the time of preparing this article, three of the four projects had been completed, and the fourth was expected to be completed in August 2012.

**CONCLUSION**

Since the construction of the roads, there has been visible evidence of economic growth within these communities, and the locals’ life styles have improved accordingly. Public transport has suddenly become available. Mobile street vendors (chicken vendors, green grocers, etc) are now able to bring their products closer to the people. More private vehicles are now using these roads, hence travel times have become much shorter. Access to hospitals and other public amenities has improved. Local youth have been empowered through the construction training programmes. In line with the government’s initiatives, SANRAL has indeed contributed substantially towards making a difference to the lives of the people in these four regions in the OR Tambo District.

---

Igbal Hoosen
Project Manager
SANRAL
hooseng@nra.co.za

---

**Learning to construct a roof truss**

**SMME engagement opportunities were offered to local residents**
ENGINEERED SOLUTIONS THROUGH TECHNOLOGY AND INNOVATION

Aveng Manufacturing Duraset’s Geotechnical division offers a comprehensive range of high quality, fully threaded bars and accessories to provide solutions for your high strength and reliability needs. These solutions include soil nails, rock bolts, ground anchors, expansion shells and hollow drill rods.

Aveng Manufacturing Duraset carries a large range of products off the shelf and caters for the needs of specialised geotechnical products for specified engineered solutions. For a full range of products, please follow the geotechnical path on www.duraset.com.

Looking ahead. For you.
Labour-intensive construction in SANRAL community development projects: the role and involvement of the community

This article should be read together with the previous one on page 63. Whereas that article focuses on the engineering aspects of SANRAL’s community-based approach, this article elaborates on dealing with community issues, such as sourcing local labour and addressing local residents’ concerns.

**INTRODUCTION**
Experience has shown that projects related to community development require the involvement of the community from the onset. The approach of the South African National Roads Agency Limited (SANRAL) is to establish a Project Liaison Committee (PLC) that has a Project Liaison Officer (PLO) as its secretariat. This approach ensures structured engagement, regular consultation, the dissemination of information and the sharing of ideas, which all support the successful implementation of the project.

**BACKGROUND**
SANRAL considers the provision of infrastructure as a primary tool to change the lives of people for the better – “creating wealth through infrastructure” in the provision of roads, improved access, job creation and other economic and training opportunities. Hence SANRAL has developed a community development philosophy and implementation model to support its national initiatives.

The article on page 63 illustrates how SANRAL fulfils its core mandate (to provide and maintain national roads) through its community development philosophy. To recap briefly – SANRAL identified and approved the construction of four access roads within the Pondoland area (Embhobheni, Mpophomeni, Matheko River to Msikaba, and Ingquza Hill to Mangwaneni), investing a total of R138 million in the process.

**PUBLIC PARTICIPATION AND INFORMATION SHARING**
As was the case in the implementation of the above-mentioned projects, SANRAL’s Community Development Specialist (CDS) is obliged to initiate communication and public participation. This is achieved by establishing Project Liaison Committees (PLCs) who have to provide structured engagement with affected communities, as well as with the Project Management Team, thus facilitating

<table>
<thead>
<tr>
<th>Stakeholder composition</th>
<th>Number of representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional leaders</td>
<td>1 per municipal area</td>
</tr>
<tr>
<td>District councillors</td>
<td>1 per district municipality</td>
</tr>
<tr>
<td>Local councillors</td>
<td>1 per municipality</td>
</tr>
<tr>
<td>Business (including local contractors)</td>
<td>1-2</td>
</tr>
<tr>
<td>Public transport/hauliers</td>
<td>1-2</td>
</tr>
<tr>
<td>Organised agriculture</td>
<td>1-2</td>
</tr>
<tr>
<td>Community-based organisations</td>
<td>1-2</td>
</tr>
<tr>
<td>Transport forums</td>
<td>1-3</td>
</tr>
<tr>
<td>Road-safety councils</td>
<td>1 per structure</td>
</tr>
<tr>
<td>Community development worker</td>
<td>1 per structure</td>
</tr>
<tr>
<td>Co-opted members : SANRAL representation</td>
<td>1 per municipal ward</td>
</tr>
</tbody>
</table>
| *Composed of Project Manager and/or CDS, Engineer and Site Manager

*Composed of Project Manager and/or CDS, Engineer and Site Manager
transparency in delivering services. PLCs also look into facilitating the economic involvement of communities during the construction process.

The CDS consults with the local leadership regarding the stakeholders who would be affected by the project. A letter of invitation and an election form are normally sent to the respective sectors’ chairpersons/secretaries to elect representatives in their own private meetings. These completed forms are returned to the SANRAL Regional Manager for approval of the elected stakeholder representatives when the tender is awarded and construction is about to start.

Generally, SANRAL has a generic structure of stakeholders as indicated in Table 1, but this tends to vary from one area of operation to the next.

This structure has a constitution that guides its operations, is signed by the chairperson on its establishment, and generally meets once a month for the duration of the project construction period. After each meeting, a PLC member goes back to report to its constituency/stakeholders, and returns with feedback to the next PLC meeting. The PLC meetings precede the monthly technical meetings since it reports to it for approval of proposals and implementation.

In addition to this structure, a Project Liaison Officer (PLO) post is created and advertised in the local media and on local public service office notice boards (e.g. municipal offices). The role of a PLO is that of secretariat to the PLC. It is a full-time post, lasting for the duration of the project, and is considered part of the Engineer’s staff. When necessary, and subject to approval from the Project Management Team, PLC members can meet more than once a month.

The Project Liaison Committees for the respective Pondoland projects were initiated in the open, as community halls do not exist in this area.

**PRIOR TO CONSTRUCTION**

Before any appointments of employees were initiated for the respective labour-based construction projects, the CDS alerted the community to the following parameters:

- Existing skills in the area would be investigated.
- The number of people willing to work, and living within walking distance would be investigated.
- Estimates of the number of people required (task workers, learner contractors, artisans, supervisors) would be obtained from the SANRAL Project Manager.
- Explanation of stipend payment during training, training test section and mock contract period.
- No food, accommodation or transport would be provided during training.
- Payment would not be per day or per hour, but based on completed work done, either per individual or per group (task-based).
- During mock and contract execution, no food, accommodation or transport would be provided.

**PARTICIPATION DURING CONSTRUCTION**

During training and construction, the community, in collaboration with the respective PLOs and PLC structures, assisted the contractor in securing candidates to be trained in NQF Levels 2 and 4. Generally 20 people were trained in NQF4, related to Construction Supervision, and 60 in NQF2 as Construction Roadworkers for each of the respective projects. This excludes other training related to life skills for general labourers and community members.

The community assisted the construction teams in many other ways, as well, which included securing local plant and labour, suppliers, SMME procurement, and dispute resolution. The localities for the establishment of site offices, bearing in mind needs such as power lines and water sources, were also investigated by the community members, as they were familiar with their environment.

The community also assisted by keeping an eye on the construction process, and alerted the contractor to potential hazards, such as possible flooding from rain, and speeding on completed sections of the road (resulting in proposals for traffic calming measures).

In instances of vandalism (removal of road survey pegs, vehicle/livestock use of unfinished road surfaces, pilfering of diesel and cement, vandalising of drums of emulsion set out for the following day’s work, overturned or stolen water drums, etc) responsible community members responded with prompt urgency, and in some cases went to the extent of conducting their own investigations, doing citizens’ arrests and handing the culprits over to the police, in addition to educating community members not to disrupt the construction programme.

---

**Figure 1 Employees’ age distribution**

- 46-55: 18%
- 36-45: 16%
- >55: 8%
- 18-35: 58%
CONcerns and Benefits
An Empowerment Impact Assessment (EmpIA) was conducted by the SANRAL CDS to establish the impact of these community development projects on the community. Almost 150 local employees from each project were interviewed, of whom 82% indicated that they had been unemployed prior the implementation of the project. Around 58% of the employees were between the ages of 18 and 35, and hence fall in the "youth" category. Figure 1 gives an indication of the age distribution.

The survey also attempted to establish what employees considered as challenges in their respective areas. The following challenges were identified:
- Lack of clean water (20%)
- Lack of agricultural activities (18%) (often due to lack of cash flow, hence tractors cannot be engaged to plough fields)
- Lack of RDP (Reconstruction and Development Programme) benefits (18%)
- Lack/bad condition of roads (17%)
- Poverty (12%)
- Lack of skills training (11%).

On investigating income use, the results of the survey indicated that at least 97% of the employees’ income was spent on poverty- and RDP-related issues as shown in Figure 2.

Employees expressed satisfaction that they can now buy healthy food, furnish/repair their homes and clothe their families. In addition they can invest in bank savings and ‘stockvels’, register companies, pay school fees, buy livestock, secure drivers’ licences and settle burial society arrears payments.

Despite the projects’ focus on road construction, there were numerous other spin-offs, of which the following are examples:
- Site offices converted to community halls where communities can meet indoors; these facilities are also generating income by being rented out for weddings, workshops, etc.
- Sustainable SMME projects like brick-making concerns, and a sewing/clothing factory.
- New and improved kindergarten playfields and properly levelled sports fields.

Concluding Sanral, through its Community Development Programme, and in conjunction with its core business of providing and maintaining national roads, is successfully addressing poverty and unemployment, thereby contributing towards restoring human dignity.

Dr Mongezi Noah
Community Development Specialist
SANRAL
noahm@nra.co.za

**Figure 2 Items on which employees spend their wages**

- Household furniture 18%
- Family clothing 18%
- Food 26%
- Future investment 16%
- Home structure 19%
- Leisure activities 3%
- Household furniture 18%
- Family clothing 18%
- Food 26%
- Future investment 16%
- Home structure 19%
- Leisure activities 3%
IN BRIEF

FIRST 40 m² CMA HOUSE OPENS A DOOR TO BETTER HOUSING DELIVERY

THE FIRST EXAMPLE of the single-storey CMA House, a 40 m² two-bedroomed unit based on precast concrete modular masonry technology, is being built at Sokhulumi Village near Bronkhorstspruit. The house is a CMA initiative which demonstrates how modular masonry can substantially improve the productivity and quality of entry-level housing delivery.

“Once the house is built, it will act as a living billboard for modular masonry, while showcasing some of our members’ precast concrete products,” says Taco Voogt, CMA president and acting director. “It also forms part of our corporate social responsibility programme and its cost is being borne by the CMA, two of our producer members and two building material suppliers.”

The CMA House is one of ten units being jointly developed by the Department of Human Settlements, the City of Tshwane and South African Women in Construction (SAWiC) for disadvantaged members of the Sokhulumi community.

SAWiC is a Section 21 (non-profit) company which supports the development of women in the housing and construction sectors. SAWiC project manager, Nqobile Kunene, says that all ten houses are being built by 17 Sokhulumi (mainly women) community members, of whom 14 are skilled artisans.

“The remaining three are being trained by SAWiC in various aspects of house construction, and the skills learnt on this project will stand them in good stead for further employment opportunities.”

CMA producer member, Technicrete, supplied 3 500 precast concrete bricks for the CMA unit, while the precast concrete roof tiles, the trussing and overlays were supplied by producer member, Aveng Manufacturing Infraset. Other contributions were made by Betcrete Gauteng, a licensee of Betcrete Western Cape, which supplied precast concrete door frames and precast concrete window frames, and Eastern Ready Mix, which supplied 15 m³ of concrete for the raft foundation.

Commenting further, Voogt says that, when properly applied, modular masonry can do much to alleviate South Africa’s housing shortage.

“Having been used locally with considerable success in the late seventies and early eighties, genuine modular masonry, in which each and every brick or building block is detailed in the architectural drawings, is rarely practised these days and its re-introduction will require a change of attitude on the part of the housing authorities, architects and building contractors.

“What we are demonstrating with the Sokhulumi house is that the extra cost involved in preparing modular masonry plans, which are much more detailed than normal subsidy housing plans, is negligible when compared to the substantial advantages which are achieved through eliminating wastage, faster construction times and a much better quality of construction.

“When one considers that most subsidy housing developments involve the construction of many houses, the additional costs that detailed/modular masonry plans entail, are rendered insignificant through amortisation.

“Moreover, the CMA House plans are available to anyone at no charge. This means that subsidy housing developers can save on the cost of detailed plan preparation by using the CMA House plans as a template for other developments. The only cost involved would be in adapting the plans to suit specific projects, which could easily be done given that the plans are CAD-based,” concludes Voogt.
DSM OPTS FOR CHRYSO PRE-SEALER TO ENHANCE FAÇADE OF ACCLAIMED RETIREMENT COMPLEX

CONCRETE BLOCKS supplied by Decorative Stone Masonry (DSM), a Concrete Manufacturers’ Association (CMA) member, are being extensively used at the Waterfall Hills Mature Lifestyle Estate to add ‘old world’ charm to the upmarket Sunninghill (Johannesburg) development, while eliminating the need for future maintenance of the exterior masonry of the homes. [See article on pages 17–20 of the July 2012 edition of Civil Engineering for more on the massive Waterfall City project. Ed]

The new facility – being developed by Century Property Developments – won the prestigious Globals 2011 Award for the world’s best retirement resort. The Globals Award is held annually to recognise excellence in over-50s residential housing.

Bapsfontein-based DSM manufactures a unique range of architectural sandstone products from a mix of light-blended cement, high-graded white silica sand and other ingredients to offer a perfectly natural sandstone façade. The addition of Chryso Southern Africa’s Pareflo 20 pre-sealer during the manufacturing process ensures that the blocks are appropriately sealed against water penetration and long-term damage caused by the harsh South African environment. The pre-sealer also eliminates the occurrence of efflorescence (a white chalky deposit that is problematic with masonry products) and prevents salt attack, mildew, moulds and corrosion under normal conditions.

DSM makes use of a secret moulding process in which ingredients, including Pareflo 20 and colouring additives, are dry-moulded in an adapted block manufacturing process before being cured in high-tech infra-red chambers. Thereafter the rock-bolstered products are split and chiselled by hand, resulting in a striking chiselled-rock look.

DSM owner, Andrew Beck, says: “Adding Pareflo 20 to the DSM product range is a simple procedure, now incorporated as standard on our entire range. It adds significant value to the end-product in terms of enhanced colours and durability and provides a completely maintenance-free and attractive alternative to face-brick construction.

“Rather than undertaking a dual process of erecting the structure and covering it with stone cladding, the architects for Waterfall Hills Mature Lifestyle Estate were able to save materials and costs by specifying DSM masonry block products. In addition, the thermally efficient hollow construction of the blocks provides an insulated building envelope which is in line with the modern green living philosophy of Century Property Developments,” Beck adds.

Commenting on the DSM manufacturing process, Chryso’s Victor Boardman explains that Pareflo 20 is both alkali- and biologically-stable, and offers long-term durability, without producing any change in the appearance of the concrete stone faces. “It is a cost-effective admixture suitable for pre-sealing coloured decorative walls and pavers, single-leaf block walls, retaining and basement walls, damp-coursing and any load-bearing blocks, as well as pavers around swimming pools and other wet areas. The degree of water resistance can be varied simply by changing the dosage. The admixture furthermore does not emit any hazardous material during application, and can easily be incorporated into any existing pressed-concrete manufacturing procedure.”

MASSIVE RETAINING WALLS CONSTRUCTED FOR MASSBUILD WAREHOUSE

TWO UNUSUALLY high retaining walls have been built at a new Massbuild warehouse site at Waterfall Distribution Park in Midrand, which is being developed by Atterbury Property Developments. The walls were erected using two concrete retaining block (CRB) systems supplied by Aveng Manufacturing Infraset – one based on in-fill and the other on in-cut technology.

Designed by Verdicon Engineers and built by Kalode Construction, the walls have facilitated the establishment of a level building site and have stabilised the very high and steep embankments which had resulted from the extensive earthworks.

Brennan Small, sales manager for Aveng Manufacturing Infraset: Construction Products, says the in-fill wall was constructed using 48 548 Infrablok™ 425 blocks.

“This wall is 336 linear metres long and reaches 11 m at its highest point. It was founded on 250 mm of unreinforced concrete and constructed at an angle of 60º.”

To meet the engineer’s reinforcing design criteria, Kaytech GX80/30 geosynthetic sheeting was inserted between the blocks and extended 2.8 m into the fill material behind the wall at intervals of every second...
row of blocks. Drainage was provided by a 100 mm Drainex pipe wrapped in stone and bidim, and outlet pipes were inserted every five metres at the bottom of the wall.

Small says the in-cut wall reached a maximum height of 12.4 m and was 114 linear metres long. It shared the same foundation and drainage specifications as the in-fill wall, but was constructed at an angle of 65° using 24 084 RidgeBloks™.

“Moreover, because the in-situ material for this wall comprised predominantly weathered granite, its shear strength design criteria were significantly higher than those employed in the in-fill wall. This meant that, although the same reinforcing sheeting was inserted at every second row of blocks, it was only necessary for its fill-material reach to be one metre instead of 2.8 m.”

In addition to the stability checks (sliding, tilting and bearing failure), which are necessary when building retaining walls, this high, global stability was also analysed using Rocscience’s Phase 2 Finite Element Analysis software.

Wall models were created using the RidgeBloks and Infrablok 425s, and material parameters for the various elements were assigned. A shear strength reduction factor analysis was also conducted to ascertain a global safety factor. The results yielded a global safety factor of 1.87, which satisfies the permanent lateral support requirement of 1.5.

According to Small the project complies with all SANS 207 requirements.
The South African Institution of Civil Engineering (SAICE) Student Chapter at Stellenbosch modelled the contest on the annual branch and national contest held for schools. Due to a lack of funding they had to put it off until this year when PERI came on board as sponsor. Riaan Brits, PERI Technical Director, says that it is a way for them to support SAICE and Stellenbosch University, thereby promoting the development of skills in the construction and civil engineering industries. PERI has made a commitment to continue sponsor-
ship and this will now become an annual event. Sonel Reynolds, Chair of the SAICE Student Chapter at Stellenbosch explains that the competition was open to all engineering students, who entered in teams of four.

THE COMPETITION
The teams convened on a Friday afternoon in August and the minimum span length of the bridges was revealed to be 700 mm. Each team was given 25 pieces of pine wood, measuring 4 x 4 x 600 mm; a limited amount of glue; bicarbonate of soda to speed up the setting of the glue; a three metre length of string; clothes pegs and needles.

Teams were allowed to plan designs ahead of time, but were not permitted to bring pre-drawn bridge outlines or pre-made bridge models into the competition area.

Contestants were given four hours to complete their design, after which they were treated to a braai, also sponsored by PERI.

On the Monday following the construction of the bridges, Riaan Brits of PERI and Professor Gideon van Zijl, Chair of the Department of Civil Engineering at Stellenbosch University, judged the bridges for their aesthetic value. The bridges were also weighed and contestants attached weights to their own bridges to determine their load-bearing capacity. These three values were used to calculate a total score.

WINNING DESIGN
The winning team consisted of four Mechanical Engineering students – Arenco Potgieter, Tanweer Mohamed, Kyle Roman and Marco Smith – and was aptly named “UnCivil”. Their bridge managed a failure load of 130 kg and they were awarded R1 600 prize money.

Professor van Zijl praised the initiative taken by the SAICE Student Chapter and thanked PERI for their contribution, saying: “This kind of competition is valuable since it stimulates creativity in students to come up with practical but aesthetically attractive concepts. It also improves their technical knowledge of strength, materials and structural behaviour, as synthesised in a working design, since they experience first-hand how it is influenced by sound implementation. It gives them the opportunity to not only compete with their peers to be exceptional, but also just to have fun with what they came to study - fine structures.”

Disaster struck early for some designs... while others proved quite indestructable.

After four hours: the finished designs.

The judges at work.

Disaster struck early for some designs...

The winning team.
Exceptional honour for SAICE’s president

THE PRESIDENT of the South African Institution of Civil Engineering (SAICE), Dr Martin Van Veelen, has been elected as the new president of the Federation of African Engineering Organisations (FAEO). Dr Van Veelen was nominated and elected for this role by the executive committee of FAEO.

FAEO is an international member of the World Federation of Engineering Organisations (WFEO). The secretariat of the FAEO is hosted by the Nigerian Society of Engineers (NSE). The main aim of the FAEO is to develop the spirit of African unity by building direct relationships between its several member organisations on the basis of mutual understanding, to direct all their activities towards improving the lives of all people throughout Africa.

The executive committee of the FAEO, through a long process of debate, unanimously accepted and adopted the FAEO constitution, which came into effect on 8 May 2012. The accepted constitution formed the basis for conducting elections for representation in the Executive Committee of the FAEO.

The new constitution recognises five regional bodies to work under the FAEO, representing Africa at the WFEO and the African Union (AU), as well as any other appropriate organisation.

The five regional bodies are the Central African Federation of Engineering Organisations (CAFEO), the East African Federation of Engineering Organisations (EAFEO), the North African Federation of Engineering Organisations (NAFEO), the Southern African Federation of Engineering Organisations (SAFEO) – formerly known as the Africa Engineers Forum (AEF) – and the West African Federation of Engineering Organisations (WAFEO).

After the adoption of the constitution, elections were concluded for the Executive Committee of the FAEO. Nominations were made for a President, and a President-Elect for SAFEO, five Vice-Presidents of the five regional engineering bodies who are also Vice-Presidents of the FAEO, and nine Vice-Presidents who chair the standing committees of FAEO.

The Africa Engineers Forum (AEF), which was established in 1995 as a network of multidisciplinary national engineering societies representing the majority of the Southern African Development Community countries, as well as Ghana and some East African Development Community countries, have all now been incorporated into the new FAEO, which represents the various geographical regions in Africa. The FAEO strives to:

- ensure an appropriate level of efficient human resource capacity in the built environment professions, especially and in particular engineering
- enable Africa to ultimately achieve sustainable development for all people in Africa
- contribute resources and expertise in partnership with key stakeholders to accomplish best practice principles of sustainable development to identified communities.

Dr Van Veelen is the new face of the FAEO. He is currently a director at Iliso Consulting in Centurion and an industry veteran with a total of 33 years’ experience in civil engineering, environmental management and project management, mainly in water-related projects. This includes extensive experience in water quality, especially water quality management, water quality monitoring and water quality assessment. He gained his broad experience in various fields of engineering, including planning, design, construction and management, as well as in academia.

SAICE wishes Dr van Veelen well on this new venture!
The latest SAICE journal

SAICE’S TECHNICAL journal, Journal of the South African Institution of Civil Engineering, which appears twice a year (in April and October), is experiencing phenomenal growth and is becoming increasingly popular with readers and contributors alike.

The publication of peer-reviewed technical papers on civil engineering remains one of the core functions of the Institution (being a learned society) and consistently adds to the body of civil engineering knowledge. This sharing of knowledge and experience was one of the main reasons why SAICE’s forerunner was formed in Cape Town in 1903. Monthly meetings at the time consisted of presenting and discussing interesting civil engineering experiences. These presentations (papers) were bound into the Minutes of the Proceedings of the Cape Society of Civil Engineers, which in later years became the Transactions of the South African Institution of Civil Engineers, and are still referred to today.

The SAICE journal is accredited with the Department of Education, and is internationally listed (ISI listing). It is also hosted on the SciELO (Scientific Electronic Library Online) website, an open-access platform which is operated under the auspices of the Academy of Science of South Africa. Their stringent admission criteria include ISI accreditation. This recognition of SAICE’s journal further enhances the Institution’s credibility as a learned society.

We trust that you will enjoy reading the bumper edition of the October journal which has been posted to you together with this edition of the magazine, and that you will find the contents informative and enlightening. For easy reference, we list the fourteen papers and one technical note alongside.

Evaluation of the standard design flood method in selected basins in South Africa
OJ Gericke, JA du Plessis

Catchment parameter analysis in flood hydrology using GIS application
OJ Gericke, JA du Plessis

What are the legal remedies available to contractors and consultants to enforce payment?
MJ Maritz, DC Robertson

A probabilistic approach for modelling deterioration of asphalt surfaces
TFP Henning, DC Roux

The wave climate on the KwaZulu-Natal coast of South Africa
S Corbella, DD Stretch

Coastal defences on the KwaZulu-Natal coast of South Africa: a review with particular reference to geotextiles
S Corbella, DD Stretch

Adjudication as an alternative dispute resolution method in the South African construction industry
NC Maiketso, MJ Maritz

Influence of mica on unconfined compressive strength of a cement-treated weathered granite gravel
MR Mshali, AT Visser

A step towards standardising accelerated corrosion tests on laboratory reinforced concrete specimens
G Malumbela, P Moyo, M Alexander

The effects of placement conditions on the quality of concrete in large diameter bored piles
GC Fanourakis, PW Day, GRH Grieve

The discontinuity required at an air valve or vent for effective pipeline de-aeration
SJ van Vuuren, M van Dijk

Definition and application of a cohesive crack model allowing improved prediction of the flexural capacity of high-performance fibre-reinforced concrete pavement materials
E Denneman, EP Kearsley, AT Visser

Prediction of the debonding/slip load of composite deck slabs using fracture mechanics
J Mahachi, M Dundu

Estimating soil plasticity properties from pedological data
GC Fanourakis

The importance of plane end-bearing surfaces when measuring the strengths of concrete core specimens (Technical Note)
T Bugai, D Kruger, RGD Rankine
FACTS AND FICTION ABOUT E-TOLLING

Professor Vanderschuren is to be complimented on her well-structured article “Facts and fiction about e-tolling” which appeared in the September 2012 edition of Civil Engineering. In it she has summarised current and past world practice in respect of toll roads, with particular emphasis on modern tolling systems in the urban context. As we all are aware, road pricing has been sporadically highlighted by academics, particularly transport economists, for some 50 or more years now, and it is only recently that some urban tolling systems have embraced this paradigm as part of the overall issue of an approach to public sector financing.

The following points, however, need to be mentioned, as they are particularly relevant to Prof Vanderschuren’s section, “What does this mean for South Africa?”

I. In South Africa we have for 30 years distinguished between rural and urban roads in approaches to tolling. In fact, the report of a Parliamentary Select Committee on Toll Financing of Roads in 1982 concluded (p xiii) that, whilst the Department of Transport was instructed to commence tolling on certain rural roads, it should “further investigate tolling for urban roads”. For 25 years we held back on tolling urban roads. Eventually world developments in respect of suitable tolling systems in congested multi-lane freeways, and also the dire shortage of funds for much needed and economically justified improvements to the Gauteng freeways, led SANRAL, after much public participation and study, to commence tolling freeways in Gauteng, using an approach not uncommon in world practice.

II. I personally gave evidence to the Select Committee, and the general gist of my documented comments was that road authorities would far prefer a sustainable and adequate income from the Exchequer than having to resort to road tolling. Herein, however, lies the rub – sustainability and an adequate quantum of funding in an earmarked fund are of paramount importance to managing road network planning and implementation. Whilst academics might put forward plausible approaches, it is in the cold light of the political process that road authorities must operate and provide the roads so necessary for the economic development of the country. My experience over decades of dealing with the Treasury on this matter is that government cannot be trusted to keep its promises regarding long-term road funding. In fact it is a political principle that one parliament (meaning a term of parliament) may not compromise a succeeding parliament. In addition, earmarking of funds of any sort is an anathema to Treasury officials throughout the world.

III. It was never intended, and in fact legally not possible, that tolls raised on a specific road would be used to “generate earmarked funds”. I personally had extensive, and often heated, discussions with the then Minister of Finance Barend du Plessis, where the principle was laid down that toll funds raised on a specific project may only be used to redeem the loan taken out to build that particular project.

IV. It is essential to realise, for reasons which space does not allow to discuss further here, that the fuel levy/tax is a diminishing resource as we go into the future. Hence the active world-wide drive to seek alternative sources of road funding. In conclusion, I welcome the article by Prof Vanderschuren as it helps highlight the fact that the whole issue is not as simple to resolve as some ‘politically motivated’ persons might wish the general public to believe. I assume that is from where the word “fiction” in the title is derived, since I do not see much fiction in her article, only facts!

Dr Malcolm Mitchell
executive@sarf.org.za

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Course Dates</th>
<th>Location</th>
<th>CPD Accreditation Number</th>
<th>Course Presenter</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCC</td>
<td>8-9 November</td>
<td>Midrand</td>
<td>SAICEcon10/00706/13</td>
<td>Theuns Eloff</td>
<td><a href="mailto:cheryl-lee@saice.org.za">cheryl-lee@saice.org.za</a></td>
</tr>
<tr>
<td></td>
<td>12-13 November</td>
<td>Port Elizabeth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge Maintenance</td>
<td>19 November 2012</td>
<td>Pietermaritzburg</td>
<td>SAICErail12/01156/15</td>
<td>Ed Elton</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
</tr>
<tr>
<td>Basics of Track Engineering</td>
<td>20-21 November 2012</td>
<td>Pietermaritzburg</td>
<td>SAICErail12/01155/15</td>
<td>Ed Elton</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
</tr>
<tr>
<td>Railway Transport</td>
<td>22-23 November 2012</td>
<td>Pietermaritzburg</td>
<td>SAICErail11/00887/14</td>
<td>Ed Elton</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
</tr>
<tr>
<td>Sanitary Drainage Systems for Buildings</td>
<td>6 November 2012</td>
<td>Midrand</td>
<td>SAICEwat12/01103/15</td>
<td>Vollie Brink</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
</tr>
<tr>
<td></td>
<td>13 November 2012</td>
<td>Cape Town</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Consultants, designers, engineers and project managers delivering innovative solutions for surface and underground mines and plants - including all studies and technical support through to full EPCM projects.

Delivering projects from concept to commissioning

www.hatch.co.za
+27 (0)11 239 5300
A world of potential in your hands

To realize visions, exceptional engineers take advantage of integrated design tools of world-class excellence...

Civil Designer will help you to

go beyond expectations.