SOUTH AFRICA'S WATER SECTOR 2011

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Published: July 2011

Cover pictures by Creamer Media and Trans-Caledon Tunnel Authority

LIST OF ABBREVIATIONS

AC – Asbestos-Cement
AfDB – African Development Bank
AMCOW – African Ministers' Council on Water
AMD – acid mine drainage
DA – Democratic Alliance
DWA – Department of Water Affairs
EAW – economic accounting for water
GDP – gross domestic product
HDPE – high-density polyethylene
MDGs – Millennium Development Goals
mPVC – modified polyvinyl chloride
RDP – Reconstruction and Development Programme
SAICE – South African Institution of Civil Engineering
SANS – South African National Standards specifications
TCTA – Trans-Caledon Tunnel Authority
TMG – Table Mountain Group
WA – Western Aqueduct
WHO – World Health Organisation
W&S – Water and Sanitation
WRC – Water Research Commission
WSA – Water Services Authorities

KEY DEVELOPMENTS

April 2010: Water and Environmental Affairs Minister Buyelwa Sonjica reveals that South Africa will need an estimated R23-billion to prevent the country's wastewater treatment works from collapsing.

August 2010: Water and Environmental Affairs Minister Buyelwa Sonjica reports that the agriculture sector will soon be required to apply for water licences in a number of catchment areas.

September 2010: South Africa appoints an Inter-Ministerial Committee to tackle the acid mine drainage issue in the Western and Central basins of the Witwatersrand.

September 2010: The United Association of South Africa lodges a Section 77 application, in terms of the Labour Relations Act, with the National Economic Development and Labour Council, in the hopes that its application will serve as a catalyst to ensure a future of clean, safe water for all in the country.

October 2010: A report on the acid mine drainage situation in the Witwatersrand is presented to the Inter-Ministerial Committee by a team of experts.

January 2011: Water resource management specialist Dr Anthony Turton declares that South Africa's acid mine drainage is "mineable".

February 2011: The National Treasury announces that investment in water services is expected to increase from R9.9-billion in 2011/12 to R10.9-billion in 2013/14.

February 2011: The South African Cabinet approves the recommendations made by a team of experts on the acid mine drainage situation in the Witwatersrand.

February 2011: Finance Minister Pravin Gordhan sets aside R225-million in the medium-term expenditure framework to tackle acid mine drainage and its associated threats in Gauteng.

February 2011: Business Leadership South Africa CEO Michael Spicer, speaking at the inaugural South African Water and Energy forum in Sandton, says that the pricing of water should reflect the cost of infrastructure required to deliver that resource.

March 2011: A panel of water experts reports that South Africa will face a water challenge until perceptions about water use and reuse change and more attention is given to preventing water pollution.

April 2011: The Water Research Commission says that the use of groundwater, in conjunction with surface water, could form a key part of the solution to South Africa's water crisis.

April 2011: Water and Environmental Affairs Minister Edna Molewa assures South Africans that the department is "on top of things" with regard to water security, allaying "concerns and fears that the country may run out of water in the future".

May 2011: The Department of Water Affairs launches a major partnership with the private sector aimed at closing the gap between water demand and supply.

June 2011: The DWA tells Parliament's Portfolio Committee on Water and Environmental Affairs that new regulations to enforce metering of all forms of water usage will be gazetted soon.

June 2011: Parliament's Portfolio Committee on Water and Environmental Affairs, holding hearings on acid mine drainage, hears that the R225-million set aside to deal with AMD will not be enough, and closer to R750-million will be needed to address the problem successfully.

WATER: A GLOBAL PERSPECTIVE

The role that water plays is fundamental to food and energy security, economic growth, maintaining health and sustaining the livelihoods of the poorest people. The availability of good-quality water is considered a condition for alleviating poverty. This means that there is a constant and ever-increasing pressure on it as a natural resource.

The demand placed on water resources is becoming ever more untenable and the world at large is far from being water secure. In many areas of the world, the demand for water is already outstripping available supply and, in many water-scarce regions, the differences between water supply and water demand are being supplemented by engineered water transfers or by pumping groundwater, which is also experiencing declining levels of supply. This situation affects not only developing countries, where water infrastructure is poor or lacking and where many people do not have access to safe drinking water, but also the developed world, where increasing demand simply cannot continue to be met.

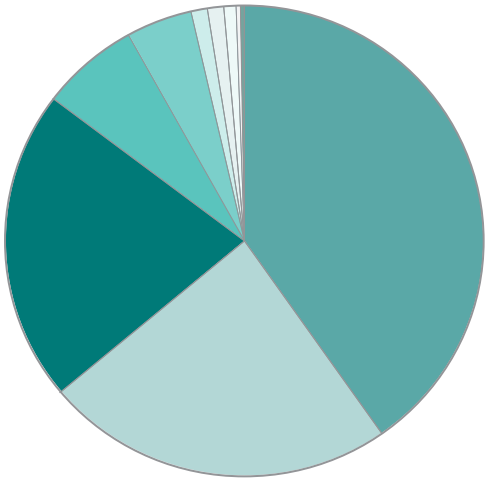
The importance of water has not always been fully respected by policy makers, economic planners and the population at large. Consequently, water has traditionally been regarded as a free resource, with any costs for water usually being associated with the cost of processing and delivery alone, rather than assigning any inherent value to this resource. However, with the global population predicted to increase to an estimated nine-billion people by 2050, alongside other factors, such as increased levels of urbanisation, changes in dietary habits, mounting demand from economic sectors, the lack of investment in water infrastructure, the negative results of poor water management, worsening water quality and the potentially damaging effects of climate change, States are progressively recognising the significance of water in economic and social development, and the need to value the resource at its true economic value.

This said, the water sector faces some overwhelming challenges.

According to the World Health Organisation (WHO) about 2.6-billion people do not have access to safe, basic sanitation, while a further 884-million people lack access to safe water sources.

The use of improved sanitation facilities – defined by the WHO and United Nations Children's Fund joint monitoring programme for water supply and sanitation as connection to a public sewer, connection to a septic

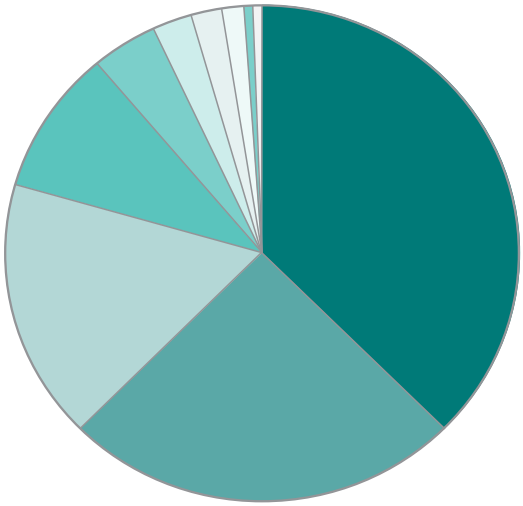
Regional distribution of people not using improved sanitation facilities in millions – 2008



- Southern Asia, 1 070
- Eastern Asia, 623
- Sub-Saharan Africa, 565
- South-Eastern Asia, 180
- Latin America and Caribbean, 117
- Western Asia, 30
- Commonwealth of Independent States, 29
- Northern Africa, 18
- Developed regions, 15
- Oceania, 5

Source: Progress on sanitation and drinking water – 2010 update

Regional distribution of people not using improved drinking water in millions - 2008



- Sub-Saharan Africa, 330
- Southern Asia, 222
- Eastern Asia, 151
- South-Eastern Asia, 83
- Latin America and Caribbean, 38
- Western Asia, 21
- Commonwealth of Independent States, 17
- Northern Africa, 13
- Oceania, 5
- Developed regions, 4

Source: Progress on sanitation and drinking water – 2010 update

system, a pour-flush latrine, a pit latrine or a ventilated improved pit latrine – around the world hides great inequalities between regions. In developed regions, almost the entire population uses improved sanitation facilities, whereas in developing regions only around half of the population has access to improved sanitation. Although there have been noteworthy increases in the use of improved sanitation in Northern Africa, South-East Asia and Eastern Asia, little or no progress has been made in the Commonwealth of Independent States and a decline in improved sanitation has been reported in Oceania. The majority of those who do not use or who do not have access to improved facilities are in Southern Asia, although, there are also considerable numbers in Eastern Asia and sub-Saharan Africa.

These disparities increase further when examining improved sanitation in rural and urban areas. Rural areas continue to have a lower percentage of people using improved sanitation and a higher number of people living without improved facilities. Even so, urban areas, although better served than rural areas, are struggling to keep up with the growth of urban populations.

Further, the WHO reports that 87% of the world population has access to improved sources of drinking water, defined as household connections, public standpipes, boreholes, protected springs and dug wells, and rainwater collection. Of the 884-million people around the world who still do not get their drinking water from safe water sources, the majority are located in developing regions in sub-Saharan Africa – 37% of them, where urban–rural disparities are particularly striking – but are also visible in Asia and Latin America.

Generally, the rural population without access to improved drinking water sources is over five times greater than that in urban areas; however, the increase in coverage in the latter is barely keeping pace with population growth.

These are astounding figures, especially since the world's population is expected to increase by an expected 2.3-billion people by 2050 – 90% of which will be in developing economies, where many of the current population already does not have sustainable access to safe drinking water and adequate sanitation.

The importance of water and sanitation within the context of international development cannot be overstated. According to a 2009 World Economic Forum report, sub-Saharan Africa loses an estimated 5% of its gross domestic product (GDP) each year as a result of poor water and sanitation and it is estimated that, for every $1 of investment in water and sanitation in these countries, $8 of benefit could be accrued. Further, by addressing the impacts, namely diarrhoea and malnutrition, related to unsafe water inadequate sanitation or insufficient hygiene in these countries, the WHO indicates that the deaths of more than 2.2-million children a year could be prevented.

While a population explosion will increase the demand for food, which will, in turn, increase the demand for water for agriculture, an increase in population numbers will not be the only driver of water scarcity.

Millennium Development Goals progress

According to the latest Millennium Development Goals (MDGs) report progress to advance access to clean drinking water globally has been robust. Globally, coverage increased from 77% in 1990 to 87% in 2008. Should this development continue, the report indicates that the MDG drinking water objective of 89% coverage will be met—and likely surpassed—by 2015.

In 92% of developing countries (103 out of 112 countries), drinking water coverage grew between 1990 and 2008 or stayed the same, at a rate of 98% or higher. Coverage only declined in 13 countries.

Regions that have already met the MDG drinking water target include Latin America and the Caribbean, Eastern Asia and South-Eastern Asia, with Eastern Asia registering the largest increase in drinking water coverage—from 69% in 1990 to 86% in 2008. Sub-Saharan Africa almost doubled the number of people using an improved drinking water source—from 252-million in 1990 to 492-million in 2008. Exposure in the region increased from 49% in 1990 to 60% in 2008.

Nonetheless, in 2008, an estimated 141-million people living in urban areas 743-million rural dwellers continued to depend on unimproved sources for their daily drinking water needs.

While progress has been made towards greater access to safe drinking water, the World Health Organisation reported in 2010 that progress on access to basic sanitation was not sufficient to achieve Goal 7c of the Millennium Development Goals (MDGs), which calls on countries to "halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation".

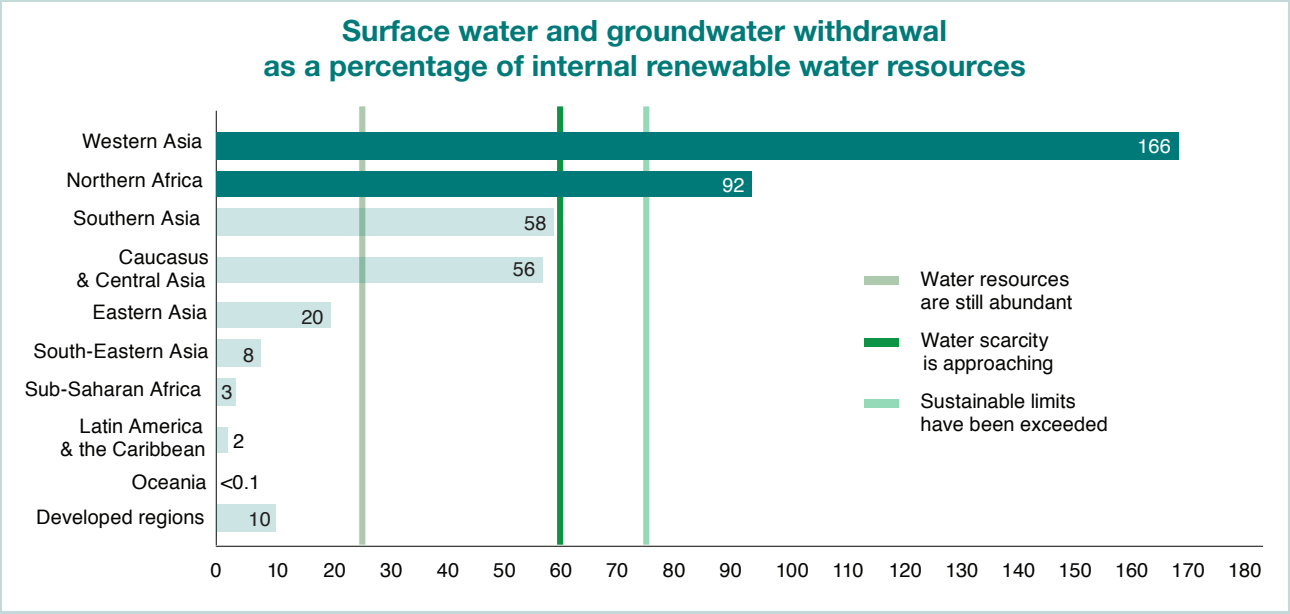
In fact the UN's MDG report states that the world is far from meeting the sanitation target. With about half the population of developing regions and some 2.6-billion people globally not using an improved form of sanitation in 2008, the report reveals that at the current rate of development, it will take until 2049 to provide 77% of the global population with flush toilets and other forms of improved sanitation.

Statistics show that around 1.1-billion people did not use any facility at all and practised open defecation in 2008, which poses enormous health risks, especially for poorer sectors of the population who are generally exposed to the dangers of inadequate human waste disposal.

Source: United Nations' Millennium Development Goals Report 2011

Limits for sustainable water resources have already been exceeded in Western Asia and Northern Africa

According to the United Nation's 'Millennium Development Goals Report 2011', the majority of regions extract under 25% of their renewable water resources. Taking into account usage trends since 1960, these regions will not approach the range of physical water scarcity for some time. However, two regions, Western Asia and Northern Africa, have gone far beyond the upper limit of 75%, meaning that their water resources are no longer sustainable. Two other regions, namely Southern Asia and the Caucasus and Central Asia, are nearing the threshold of 60%.



Source: UN Millennium Development Goals Report 2011

Rural-urban migration will have a noticeable effect on the availability of water. A report by the Royal Academy of Engineering states that, owing to urbanisation, 60% of the global population will be living in urban areas by 2030, which will have significant impacts on water resources and place them in direct competition with agriculture for water supplies. This will place further strain on water supply and sanitation infrastructure, which, in many countries including the developed ones, is well below what is required.

Urbanisation also brings with it environmental impacts, which alter natural land surfaces into impermeable surfaces, such as tarred roads, buildings and other types of structures, which block the passage of rainwater and snowmelt into the earth. This increases the flow velocity of water over land, carrying with it polluting materials and depositing these into rivers, lakes and dams, deteriorating water quality and causing pollution problems. Industry, which accounts for some 20% of global water usage, is also a major source of water pollution, with the Royal Academy reporting that some 300-million to 500-million tons of heavy metals, solvents, toxic sludge and other wastes accumulate each year.

Lack of water security, however, is not only the outcome of having insufficient water. It has been proven internationally that water scarcity does not, in itself, decide the success or failure of a country's economic and social development. It is more important – and this has been established at a global level – that countries recognise the limits of their water endowments and live within those limits. However, few countries are cognisant of the quantity of water being used within their borders, for what objectives that water is used for, the measure and quality of water that is accessible and that can be withdrawn without serious environmental consequences or of how much is being spent on water management and infrastructure.

Country examples from the World Bank indicate that, should countries practice good water management, GDP could increase by between 5% and 14% – an outcome that may not be feasible through any other interventions.

The United Nations General Assembly declared access to clean water and sanitation a human right in July 2010, thus, there is an urgent need to improve how water resources are developed and managed as a way to promote growth and lessen poverty while, at the same time, ensuring environmental sustainability. Implementing this right will be a particular challenge in Africa where a large percentage of the population live in water-deprived areas.

WATER IN AFRICA

After Asia, Africa has become the fastest growing region and is home to five of the seven fastest growing economies. Between 2005 and 2010, Africa's urban population grew at a rate of 3.4%, and its rural population by 2.3%.

Ostensibly, the continent seems to be endowed with water resources aplenty to meet its population's needs. Africa has a large number of transboundary water basins – there are about 80 transboundary river and lake basins on the continent and effectively all sub-Saharan African countries and Egypt share at least one international water basin. The Nile basin encompasses ten countries, the Congo and Niger basins nine each, the Zambezi eight, the Volta six, and Lake Chad five. Then there are countries through which several international rivers pass. One extreme case is Guinea, which has 12 such rivers.

The region also has considerable wetlands and, although limited, pervasive good-quality groundwater resources.

Africa's total renewable water resources

Source: Africa Water Atlas from the United Nations Environment Programme's Global Resource Information Database

Nonetheless, Africa is the world's second-driest continent, after Australia. The Africa Water Atlas estimates that, while Africa has 15% of the global population, it has only 9% of global renewable water resources. Further, water on the continent is unequally distributed, rainfall is inconsistent and the climate is extremely erratic, with some regions experiencing manifest and often extreme wet and dry seasons, while longer climatic cycles include years of drought.

That said, several countries in Africa face considerable constrictions in the availability of water, although particular national challenges diverge. Countries in the interior of North and West Africa are challenged by absolute physical water scarcity, where access is nonexistent or limited. In the east of the continent, a number of States experience extreme variability in rainfall. Sub-Saharan Africa, to a great extent, faces economic scarcity, where finding a reliable source of safe water is often time consuming and expensive, owing to financial restraints to manage the limited quantity of water available. In Central Africa, countries such as the Democratic Republic of Congo and Cameroon must administer and harness the potential of large resources of water for economic development. Other countries, such as South Africa, have almost fully exploited existing fresh water resources and are challenged by quality-based scarcity as water pollution and other activities, such as over pumping of aquifers, have turned available water unusable without extensive treatment.

Interestingly, 75% of the region's drinking water is provided by groundwater resources, which account for only 15% of total renewable water resources. Rapid population growth and economic development is expected to place considerable reliance upon this resource in future, as rainfall and freshwater from rivers and lakes becomes more variable and, as a result, less reliable owing to climate change.

However, this is not the only factor influencing water scarcity on the continent. The increase in the demand for water is not only being exacerbated by the growing population, but also by issues such as poor city planning and water and sanitation management, a lack of resources, and competition for available freshwater between industrial, municipal, agricultural and tourism sectors, and often between upstream and downstream users. This has resulted in a situation where the quantity and quality of water may not be sufficient to provide ample safe drinking water and sanitation, which may constrain economic development.

PROGRESS MADE BY AFRICAN GOVERNMENTS

African heads of State have shown increased political commitment and leadership to resolving water and sanitation issues in recent years.

In 2008, several significant water-related commitments and declarations were ratified by African heads of State and African governments. These include the eThekwini Declaration and AfricaSan Action Plan, the Sirte Ministerial Declaration on Water for Agriculture and Energy, the Tunis Ministerial Declaration and the Sharm el-Sheikh Declaration on Water and Sanitation.

Established in 2002, the African Ministers' Council on Water (AMCOW) provides political leadership, policy direction and advocacy in the provision, use and management of water resources for sustainable social and economic development and maintenance of African ecosystems. In 2009, AMCOW became a specialised technical committee for water and sanitation in the African Union, in what was considered to be an important milestone towards Africa's water security.

The council is said to be progressively influencing the region's water plans through committed engagement with the African Union, African Development Bank (AfDB) and other key entities, such as the New Partnership for Africa's Development, UN–Water Africa, and regional economic commissions including the Southern African Development Community, the Economic Community of West African States, and the East African Community.

Nonetheless, despite commitments and declarations by political leaders these initiatives have not yet translated into national policies and the investments necessary to address the lack of progress.

Only an estimated 0.2% of GDP is being invested in sanitation and hygiene, meaning that the majority of African countries have failed to achieve the 2010 targets of the eThekwini Declaration, which called for the sector-specific provision of 0.5% of GDP. As a result, total investment in Africa's water sector remains far below the AfDB estimate of the $11-billion a year needed to meet the continent's drinking water supply and sanitation needs.

However, according to the panellists of Mobilising Investments for Africa, which was hosted by the government of Senegal in April this year, there is a $30-billion to $50-billion a year shortfall for water investment needs and sustainable management in Africa, while what is available is not being used to its full potential.

Should the low level of investment finance not be addressed, growth in the water sector will continue to be hampered.

Progress in drinking water and sanitation targets

As with other regions in the world, the quality of drinking water and sanitation in Africa is worse in rural than in urban areas, with drinking water coverage being approximately 85% in urban areas and 51% in rural areas, and sanitation coverage being in the range of 53% in urban areas and 29% in rural areas.

As a whole, the region is not expected to meet the Millennium Development Goal (MDG) target to halve the proportion of the population without sustainable access to clean drinking water or to meet the MDG target of halving the number of people without sustainable access to basic sanitation by 2015. In fact, as of 2010, only 26 out 54 African countries were on course to meet the clean drinking water target and only six were on track to meet the basic sanitation target. Further, the

United Nations Economic Commission for Africa's 2010 MDG report states that improvements in sanitation for the most part remain an urban phenomenon. Open defecation is still common in rural areas and has not been stamped out in many urban areas of the continent. The report indicates that, in 2008, excluding North Africa, the number of people practicing open defecation was 199-million in rural areas and 22-million in urban areas.

This is worrying as access to improved drinking water and sanitation are essential to economic growth, health and the alleviation of poverty.

The mutually dependent relationship between water and economic development is illustrated by the link between water and poverty that is made in the African Water Vision 2025: "Due to poverty, access to adequate water and sanitation is low in Africa. Yet, due to the inadequate access to safe water and sanitation, there is a high incidence of communicable diseases that reduce vitality and economic productivity on the continent inadequate access to water and sanitation is, thus, both a cause and a consequence of poverty."

Therefore, the provision of better water supplies to Africa's growing population and building water security is key to Africa's continued economic and social development. Simple policy interventions, such as public and community toilets, better water sources, and improved water management could go a long way towards not only accelerating improved sanitation but realising the potentially massive economic rewards that could be achieved by unlocking hydropower potential, irrigating fertile land for agriculture and sustaining industrial expansion.

WATER IN SOUTH AFRICA

South Africa is one of the driest countries in the world but, while the country's resources are limited, it supports a dynamic, growing economy and provision of services. It is one of the few jurisdictions in the world that provides for an explicit right to water in its constitution. Section 27(1)(b) of the Constitution guarantees the right to sufficient water and places an obligation on the State to take "reasonable legislative and other measures, within its available resources, to achieve the progressive realisation" of this right.

This said, South Africa uses a comparatively high percentage of its available water and there is growing concern, bordering on general consensus, that the country could experience a water crisis in the not-too-distant future, along the lines of the electricity crisis experienced by State-owned utility Eskom in 2008. This relates particularly to limited financial resources and institutional capabilities – given a chronic lack of skills in the sector and, hence, what is generally described as inadequate management of infrastructure, especially at local government level – rather than limitations of the resource.

Studies have shown that there is sufficient water to meet all the country's requirements until 2025 and beyond, provided that "appropriate and timely corrective measures" to counter the effects of industrialisation and urbanisation on South Africa's water resources are taken. Current population projections by Statistics South Africa estimate that South Africa's population will grow to 53-million people by 2025 The implication from a water demand perspective is that domestic share-of-water use will shift from the current 27% to between 30% and 35% of the total national use.

Consequently, if the proper investments, advancements and management decisions are not made at the appropriate time, water crises may develop. This could see jobs and livelihoods affected, taps running dry and the needless spread of disease.

Thus, the prospect of a looming water crisis has brought the issue of water security to the fore.

Already water-management areas are experiencing water deficits, such as those in the Western Cape; ecosystems and water resources are under pressure by various users; and available resources and appropriate water resources are being affected by decreasing water quality, which, in turn, affects net availability.

WATER QUALITY AND AVAILABILITY

Water security encompasses water quality and availability aspects.

In addition to making sufficient quantities of water available for use at specific locations and at the required times, it is essential that water also be of appropriate quality for the intended use, as having water that is too polluted to use is often as bad as having no water at all.

The quality and availability of water in South Africa has become a complicated challenge. This is largely the outcome of higher industrial and mining activity, as well as from a sharp increase in urbanisation, which has added to the historical backlog, placing access to municipal services under pressure and highlighting the desperate need for additional infrastructure.

Water quality

All domestic water supplies have to comply with the South African National Standards specifications (SANS) 241, which meets all international drinking quality standards. Although all municipalities are legally required to monitor their drinking water quality, owing to lack of capacity, not all municipalities do so on a continuous basis.

Parameters for water quality that have come up for particular scrutiny countrywide include:

- Salinity – the amount of dissolved salt in water;
- Eutrophication – the process whereby nutrients accumulate in a body of water, encouraging an explosion of plant life and algae, thus reducing the amount of available oxygen in the water and ultimately suffocating plant and animal life;
- Microbial contamination – generally the contamination of a water source by disease-causing microorganisms;
- Endocrine disrupting compounds – chemicals that can interfere with the normal hormone function in humans and animals
- Microcystins – cyanotoxins that can be extremely toxic for plants, animals and humans; and
- Radionuclide and heavy metal contamination – resulting from many years of heavy metal mining and potentially dangerous to the environment, animals and humans.

A DWA report – A Drinking Water Quality Framework for South Africa – released in 2005, stated that investigations showed an unacceptably high incidence of poor drinking water quality in nonmetro South Africa. The report cited a number of reasons for the poor quality of drinking water standards, including:

- A lack of understanding by Water Services Authorities (WSAs), regarding the requirements for successful drinking water quality management;
- Poor management including monitoring of drinking water services;
- Poor infrastructure management;
- Insufficient WSA institutional capacity (staffing, funding, expertise, education); and
- Inadequate interventions to tackle poor drinking water quality when identified.

In response, the DWA instituted a drinking water quality regulation programme, with the aim of ensuring the improvement of tap water quality through compliance monitoring, which subsequently led to the initiation

of an incentive-based regulation programme, termed the Blue Drop certification system, that began in September 2008.

Blue Drop certification

Blue Drop certification aims to test the quality of drinking water provided by South African municipalities and water authorities. Only municipalities that score 95% and above are awarded Blue Drop status. In 2010 municipalities were assessed on nine criteria instead of six, with water safety plans, asset management and drinking water quality performance introduced as new requirements in the year.

The 2011 Blue Drop report, released in June this year, indicates a general trend of improvement in the management of drinking water quality, with 914 water supply systems in 162 municipalities assessed in 2011, compared with 787 systems in 153 municipalities in 2009, showing a marked improvement in submissions by municipalities.

Of the systems assessed, 59% achieved Blue Drop scores of over 50% in 2011, compared with 47% of the systems having achieved this result in 2010.

On a provincial level, the report showed that all provinces increased their Blue Drop scores in 2011, when compared with the results of the first assessment in 2009.

Gauteng and the Western Cape had the highest 2011 Blue Drop scores with 95.1% and 94.1% respectively. Ugu district municipality, in KwaZulu-Natal, scored the highest Blue Drop score with 98.8%. The municipality received Blue Drop certificates for four of its water supply systems.

However, compared with the results from 2010, the scores of the Eastern Cape, Mpumalanga and North West declined, with Mpumalanga's decrease being the most dramatic from 65.4% to 56.5%. Mpumalanga also had the lowest 2011 Blue Drop score of all provinces, although the Steve Tswele local municipality in the province was the recipient of the highest number of Blue Drop certificates, receiving six awards. In all Mpumalanga received eight awards – the second highest number of awards after the Western Cape, which received 29 awards.

Altogether, the number of Blue Drop awards given increased from 25 in 2009 to 66 in 2011.

Municipalities that used water boards to manage their drinking water systems dominated the awards, with DWA deputy director-general Helgard Muller suggesting that more municipalities should consider the option of using private operators and already established water boards.

Muller also reported that South Africa had the technical capacity in the private sector to carry out these services effectively and didn't rule out the possibility that, in future, the DWA may look at implementing legislation that could allow the department to compel municipalities with poor management of water quality and wastewater treatment to use private sector operators that have the technical skills and knowledge readily available.

Meanwhile, in June this year, the DWA presented proposed amendments to water quality regulations to delegates attending the third Municipal Water Quality conference in Cape Town. Regulation five will require water services institutions to have a comprehensive drinking water quality plan in place, which includes a programme for regular analysis of water samples by accredited or DWA-approved laboratories.

The regulation also stipulates that analysis results should be submitted to the DWA monthly and published yearly. The published results should compare the results obtained for municipal water against SANS 241 for drinking water quality specifications, as well as comply with the standards. Should the results not comply, the regulation also states how reporting to the regulatory and government authorities should be carried out, and the public advised if any health risk is identified.

Further, the DWA discussed draft regulation 17, which is concerned with ensuring that process controllers of water plants are properly qualified and correctly registered. The regulation also deals with issues of continuous professional education of process controllers and how to handle the situation of existing process controllers who are currently underqualified.

The draft regulation has been submitted to the chief state law adviser, who has questioned some sections, which, in all likelihood will have to be amended.

Green Drop certification

Recent investigations and audits of wastewater treatment and compliance with relevant legislation on water concluded that the municipal wastewater business, which treats billions of litres of wastewater each day, was generally considered to be far from acceptable, when compared with the required national standards and international best practice. In an effort to address these gaps and improve the performance of municipal wastewater service providers, the DWA introduced the Green Drop certification scheme.

The Green Drop report released in June 2011 shows that the number of wastewater treatment systems assessed increased significantly over three years, from 449 systems in 2009 to 821 systems in 2011, treating an estimated 5.258-billion litres of effluent a day.

Of the 821, 40 were found to be in excellent condition, 78 were in good condition, 243 were average, and 143 performed poorly. It said 317 plants were in critical condition.

Six provinces received Green Drop awards, with the Western Cape leading the pack with 19 awards – the highest number for any province in 2011 – followed by KwaZulu-Natal with 11. However, 20 of the wastewater treatment systems that were previously awarded Green Drop status lost that status in the 2011 assessment.

While an analysis of the Green Drop results showed a reasonably good national score of 71%, this value might be distorted, as a few excellent provincial scores would offset the lower provincial performer's scores.

The Green Drop report also showed a negative trend in the quality of the wastewater treatment services, with the number of systems scoring more than 50% having decreased from 49% in 2009 to 44% in 2011.

Wastewater treatment services in Limpopo and the Free State are in a particularly dire state, with these provinces scoring only 24% and 32% respectively. "The bulk of the Free State municipalities did not meet the requirements of the regulation programme. With the exception of some positive trends, it is the regulatory impression that the wastewater services management are not on par with good practice and legislative compliance," the report stated.

Further, not one of the water-treatment plants in Limpopo received an award, signifying that the performance of the entire province was weak. As a result, the DWA has said that the monitoring of water-treatment systems in both provinces will be prioritised because of the high risk they pose.

The report also indicated that in the Eastern Cape, 64% of the province's sewerage works posed health and environmental risks and suggested that renewed efforts be made "to compel plants into medium-and low-risk positions".

These results show that challenges remain in wastewater management and highlight a lack of human capacity and maintenance of treatment systems as some key concerns.

At the launch of the Green Drop report in April last year, then Minister of Water and Environmental Affairs Bulyelwa Sonjica said that South Africa would need about R23-billion to prevent the country's wastewater treatment works from collapsing, although she refuted claims that sanitation was in crisis.

The DWA has since reported in its Strategic Plan 2011/12 to 2013/14 that a huge backlog has developed in the regional bulk water and sanitation infrastructure owned by municipalities, including water treatment and wastewater treatment plants. Surveys done jointly with local governments estimate the backlog at R110-billion. The department has budgeted R5.4-billion over the next four years to reduce this backlog. This amount excludes the funds that have been allocated in the budgets of local governments.

Nonetheless, the Green Drop findings imply that millions of litres of untreated or poorly treated sewage is being discharged into rivers and streams each day, which affects water availability.

Water availability

South Africa's rainfall is, by and large, low and unpredictable with an average yearly rainfall around 500 mm, compared with the world average of 860 mm, with some 21% of the country receiving less than 200 mm/y.

The country is considered water stressed in terms of total actual renewable water resources per person per year, which stood at an estimated 1 110 m^3 of water per person in 2005. A Development Bank of Southern Africa working paper states a country faces water stress when water resources fall below 1 667 m^3 per capita, water scarcity when there is less than 1 000 m^3 of water per capita and absolute water scarcity at below 500 m^3 per capita.

South Africa's water availability is currently based on surface water (77%), return flows (14%) and groundwater (9%). Reconciliation studies undertaken in major urban centres have revealed that, in addition to these sources, desalination and effluent reuse should also be considered by the DWA for long-term water security given the high risk of water shortages, the fact that 98% of the country's water resources are fully developed, the significantly long lead times associated with building large dams and associated infrastructure and the portend of future periods of poor rainfall.

While a large number of water users rely on surface water for their needs, the majority of small water supplies depend on groundwater. The Water Research Commission (WRC) believes that the use of groundwater, in conjunction with surface water, could form a crucial part of the solution to South Africa's predicted water crisis.

The WRC has said that the total volume of available, renewable groundwater in South Africa is 10.34-billion cubic metres a year of which South Africa is currently using between two-billion and four-billion cubic metres a year. Conversely, the WRC has found that the assured yield of South Africa's surface water resources is about 12-billion cubic metres a year, although a significant percentage of this has already been allocated.

Therefore, there is the potential to significantly increase groundwater use in the country, as it is a safe, generally clean and reliable supply of water. In fact, the most recent scientific estimates place groundwater in South Africa in the same league, volumetrically, as stored surface water resources. The challenge remains to optimally develop and manage groundwater as part of the total resource as, even with South Africa's strong groundwater research capacity, research is not always optimally coordinated between institutions and outcomes are not always implemented.

Thus, groundwater needs to be managed in a sustainable manner by implementing a number of diverse interventions, such as knowledge management and cooperative governance. Also, some banks say they will not fund groundwater projects because groundwater is not considered a secure resource. This view needs to be changed.

During this financial year the DWA has said that it will focus on monitoring of groundwater resources, especially acid mine drainage, transboundary aquifer systems, climate variability and municipality systems.

A key theme of the groundwater strategy is institutional capacity, functioning and support, which means water management institutions must be structured and mandated in such a way that groundwater development and management can be optimally achieved.

Further, the DWA has recommended that optimal systems operation should be implemented to save water and achieve equitable water distribution, and that water collection and water demand management should be implemented, including infrastructure rehabilitation and maintenance.

Other possible solutions for increasing water security and delivery include implementing water monitoring systems for accountability and early warning, as well

Acid Mine Drainage

In December 2010, a 146-page report on acid mine drainage (AMD) compiled by a team of water and geology experts was presented to the Inter-Ministerial Committee on AMD. In the report, experts recommended that AMD intervention and management measures be undertaken "as a matter of urgency" to "avert impending crises and stabilise the situation".

The report is a summary of key AMD issues and acknowledges the challenge of AMD, not only in the Witwatersrand area but in other parts of South Africa, including the Mpumalanga and KwaZulu-Natal coalfields and the O'Kiep copper district, in the Northern Cape.

As in many other parts of the world, the activities of the mining sector have resulted in some serious environmental consequences, notably poor environmental and water management and, in the case of the gold mines of the Witwatersrand, AMD.

AMD is a considerable and expensive environmental impact of the mining industry, and it is a global problem. The mining operations of previous generations continue to have an effect on surface and groundwater resources long after mining operations have come to an end. The oxidation of sulphur-rich mine wastes by interactions with water and oxygen and the consequent release of AMD is one of the major environmental challenges facing the mining industry.

Concerns about the flooding of the mine voids and/or AMD decant include:

- AMD extensively contaminates surface streams and could precipitate devastating ecological impacts.
- Rising water levels could flood urban areas and result in geotechnical impacts that may jeopardise the integrity of urban infrastructure.
- Rising water levels in mine voids may lead to an increase in seismic activity, presenting serious safety risks to deep underground mining ventures and some risk to safety and property on the surface in the vicinity of the mines.
- Rising mine water levels have the potential to flow towards and pollute adjacent groundwater resources.
- Flooding may result in intermine water migration and may threaten neighbouring operational mines, limiting access to economic reefs.

Analysts contend that the only way to deal with the AMD challenge is through healthy and trusting relationships, particularly between government and the mining sector.

This is echoed in the AMD report, which states that national and international AMD management practices indicate that private-sector initiatives are unlikely to be economically sustainable without an appropriate financial arrangement, which could include water user levies and contributions from the mining industry.

In the case of the Witwatersrand, the report identifies two options, the first being that the State will fund and operate short-term measures to manage AMD in the Witwatersrand's Western, Central and Eastern basins through one or more of its agencies.

The second option is to allow the mining sector and private initiatives to treat AMD and sell to the market, which may still require a State subsidy.

In fact, former Council for Scientific and Industrial Research scientist and director of Touchstone Resources, Anthony Turton, has said that consideration should be given to studying the economic feasibility of "mining" South Africa's AMD and wastewater for metals, minerals, salt and even hydrogen.

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as capacity building of staff, users and management institutions. Continuous research for new and improved management technologies and moving from inefficient to efficient water use, have also been mentioned.

Without urgently implementing such solutions, government will not be able to meet the objectives of the New Growth Path and provide clean, reliable water and good sanitation facilities to its citizens, and could be plunged into a crippling water shortage crisis by 2026.

WATER SUPPLY AND SANITATION

While the right to water may be enshrined in the Constitution, a major challenge inherited by the new South Africa relates to the very provision of this right.

In mid-2010, a story emerged in the South African press of a settlement in Cape Town in which residents had been provided with unenclosed toilets. The case was referred to the South African Human Rights Commission, which made a preliminary ruling that these "open-air" toilets were a violation of human dignity.

The unenclosed toilets were installed by the City of Cape Town, which is run by the Democratic Alliance (DA), South Africa's official opposition party. The DA believed that it had reached a conditional agreement with the Makhaza community that, instead of building one enclosed toilet for every five households in the area, as is the national norm, it would provide a toilet for every household if the residents constructed the enclosures themselves. Later, the council agreed to provide galvanised iron enclosures for the unenclosed toilets. However, the youth league of the ruling African National Congress seemingly incited residents in the affected area to demolish the enclosures once they had been erected. This took place twice, before city workers removed the toilets. The city and province said they would reinstall the toilets once the youth league gave assurance that it would not break down the enclosures again.

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Acid Mine Drainage

Turton is a protagonist of "mining" not only AMD but also the water in sewage works, to obtain phosphate as a by-product, which is crucial for food security.

A key problem in AMD thinking is that the acidic water volumes are too small to be profitable. But, by combining AMD and sewage water, Turton believes that volumes may be increased to the point of providing economic viability and that, in the process, water will be sufficiently cleaned to enable safe discharge back into natural streams, or be cleaned to a potable standard, and then injected into an aquifer to overcome the psychological barriers.

Turton believes that a well-considered government policy pronouncement can create the enabling environment for venture capital to be attracted into experimental AMD/wastewater ventures.

Following Cabinet approval of recommendations made by the team of experts on AMD in the Witwatersrand, Finance Minister Pravin Gordhan indicated that R225-million had been set aside in the medium-term expenditure framework to tackle AMD and its associated threats in Gauteng. Water and Environmental Affairs Minister Edna Molewa will take the lead in consulting industry on a shared and coordinated response.

Further work to develop long-term technically feasible and financially viable approaches and solutions to the management of AMD are still being deliberated.

Areas that need intervention include the Western, Central and Eastern basins in the Witwatersrand area, where mining has been taking place for more than a century.

In the Western basin, intervention will require the establishment of a neutralisation plant with a capacity of 20-million litres a day to supplement the existing treatment capacity operated by gold/uranium miner Rand Uranium. An upgrade of mine water pumping facilities will also be required.

In the Central basin, a pumping facility with a capacity of about 60-million litres a day will need to be installed in one or more of the existing mine shafts, and a neutralisation plant or plants of matching capacity will need to be established nearby.

Expanding on the problem in the Central basin, which is the largest, the AMD report states that the water level has been rising at an average daily rate of 0.59 m/d since July 2009, varying seasonally between 0.3 m/d and 0.9 m/d. By the end of last year, the water was about 510 m below the surface.

It is predicted that the rising water level will reach the surface by March 2013.

In the Eastern basin a single pump station at the Grootvlei mine is operating sporadically. The mine pumps out between 50-million and 70-million litres a day of mine water, while an estimated 108-million litres a day is needed to maintain the water balance. Considerable financial and managerial constraints have resulted in the mine being unable to discharge to standards set out in its water licence. The danger is that substandard effluent is flowing into the Blesbokspruit – a wetland.

In May 2011, in a judgement handed down in the Western Cape High Court the judge said that an agreement between the city and Makhaza community for the construction of about 1 316 unenclosed toilets was unlawful and the city was ordered to enclose the toilets.

The political angle aside, this is not a particularly unusual story. Indeed, South Africa's water and sanitation backlog remains a significant challenge.

Access to basic water supply infrastructure

According to the DWA, out of a population of just under 50-million people there are currently an estimated 1.65-million people with no access to a basic level of water supply, and a further 1.98-million people with access to a water supply but one that does not meet the service levels that are outlined in government's Reconstruction and Development Programme (RDP). The RDP standards prescribe a minimum quantity of 25 l/d of potable water per person within 200 m of a household and not interrupted for more than seven days a year and a minimum flow of 10 l/y per person for communal water points.

Local government's aim for 2009/10 was to supply 1.5-million more people with basic water supply – the department provided basic water supply to 1.07-million.

According to the Presidency's development indicators for 2010, since 1994 access to water supply infrastructure in the sector improved from 59% to 93.8% of the population by March 2010. The DWA quotes figures of 97%. This includes all people that benefit from access to infrastructure, including those that receive services below the RDP's basic supply levels.

Government maintains that South Africa is likely to achieve the MDG target of universal access to potable water by 2015.

Access to basic water infrastructure					
Period	**Estimated population**	*** Number of people with access to water supply infrastructure**	**Number of people with access to basic services but below RDP service levels**	**Number of people with no access to infrastructure**	**Access to water supply infrastructure**
2009/10	49.9-million	48.3-million	1.98-million	1.65-million	97%
People served April 2009 to March 2010	-	1.07-million	-	-	-
Previous year 2008/9	49.7-million	47.6-million	2.6-million	2.1-million	96%
People served 1994 to March 2010	-	20.79-million	-	-	-
1994	39.8-million	23-million	-	15.9-million	59%

Source: DWA annual report 2009/10

* "Access to water supply infrastructure" includes people served to higher than basic RDP levels of service, as well as those with "access to basic services but below RDP service levels". The figures only reflect infrastructure provided and do not reflect quality of ongoing service provision. Water supply backlog figures are based on the 2001 Census and updated using information obtained on projects that have been implemented across the sector. Population figures are based on Statistics South Africa midyear estimates and have been adjusted to reflect annual population growth. The information on how many people were served is based on input from the Department of Water Affairs and the Department of Cooperative Governance and Traditional Affairs, which excludes the delivery through municipalities' own funding or any other resources. Should this be considered, the delivery figures may increase.

Access to basic sanitation infrastructure

In 1994, only 49% of the population had access to basic sanitation, since then 13.98-million people have been served with basic sanitation infrastructure.

In 2009/10 local government set the goal of supplying 300 000 more households with basic sanitation, which it exceeded by 77 000, reflecting 3% growth from the previous year's figure of 76% of the population with access to basic sanitation.

Government says that it is likely that South Africa will achieve the MDG related to sanitation by 2015.

Despite the backlogs that remain, South Africa's water and sanitation situation is a vast improvement on the situation that was inherited from the apartheid government in 1994. At that time, there were over five-million households without access to sanitation and almost four-million households without access to adequate potable water. It was estimated that over 20-million people did not have access to suitable sanitation, and almost 16-million were without access to clean, safe water.

Government is making efforts to continue to eradicate the water and sanitation backlog. However, the delivery of these services will have little meaning for the poor if they cannot afford user fees to pay for these services. Recognising this, a free basic water policy was announced in 2000, allowing for each household to receive the first 6 000 l/m of potable water free of charge. By 2010, 86.1% of households were benefiting from this policy. Government is also pursuing a strategy for the roll-out of free basic sanitation.

These free basic policies are going some way towards successfully recognising water and sanitation as human rights, as provided for by the South African Constitution. However, those who still do not have access to water infrastructure or sanitation are unable to benefit from the free basic policies.

Bucket eradication programme

The bucket eradication programme, which was instituted in February 2005 to stamp out the bucket system set up in established settlements that existed before 1994, has seen the removal of over 244 258 buckets since its inception.

The bucket system is used in areas where there are no waterborne, or other sanitation services and involves the collection of buckets of 'night soil', often by the municipality.

In 2009/10, 1 048 buckets were eradicated, leaving a backlog of 7 996 buckets in the Free State, Eastern Cape and the Northern Cape.

WATER INFRASTRUCTURE

The DWA is accountable for much of South Africa's bulk water infrastructure, in addition to policy and regulation, while municipalities or municipalities and water boards are responsible for local water quality and provision.

Access to basic sanitation infrastructure * (in millions)				
Period	**Estimated population**	**Supply, basic level or higher**	**Supply, below RDP**	**Access to services**
2009/10	49.9-million	39.42-million	10.56-million	79%
People served April 2009 to March 2010	-	1.63-million	-	-
Previous year 2008/9	49.7-million	37.6-million	12.1-million	76%
People served 1994 to March 2010	-	13.98-million	-	-
1994	39.8-million	19.4-million	20.4-million	49%

Source: DWA annual report 2009/10

* "Access to water supply infrastructure" includes people served to higher than basic RDP levels of service, as well as those with "access to basic services but below RDP service levels". The figures only reflect infrastructure provided and do not reflect quality of ongoing service provision. Water supply backlog figures are based on the 2001 Census and updated using information obtained on projects that have been implemented across the sector. Population figures are based on Statistics South Africa midyear estimates and have been adjusted to reflect annual population growth. The information on how many people were served is based on input from the Department of Water Affairs and the Department of Cooperative Governance and Traditional Affairs, which excludes the delivery through municipalities' own funding or any other resources. Should this be considered, the delivery figures may increase.

The department's Strategic Plan for 2011/12 to 2013/14 indicates that there are 264 water schemes across the country, comprising mainly dams, canals, pipelines, tunnels and measuring facilities with a replacement value (excluding land) of R139-billion and a current value of R54-billion, with decrease in value at an estimated R1.4-billion a year.

The expected life of infrastructure ranges, at component level, from ten years (for small motors) up to 300 years (for dam walls) and is ageing, with over 75% of assets built between 1960 and 1990, while some assets are over a century old.

Consequently, government is facing a number of key challenges that include the refurbishment of infrastructure

Summary of estimated capital expenditure on water resource infrastructure mega projects

Project name	Type of infrastructure[1]	Service delivery outputs[2]	Province	Estimated completion date	Current project status[3]
1	2	3	4	5	6
Mega projects (Over R330-million a year for a minimum of three years, or R1-billion total project cost)					
Olifants River Water Resources Development Project (ORWRDP) (Phase 2A) – De Hoop dam	Dam	Water supply to new mining developments, supplementation of water supplies to Polokwane and to supply water for primary use to various communities on the Nebo Plateau and Steelpoort valley	Limpopo	2013	Construction
Olifants River Water Resources Development Project (ORWRDP) – bulk distribution system	Pump stations, pipelines	Bulk distribution works from Flag Boshielo to Mokopane, De Hoop to Steelpoort link, Steelpoort to Mooihoek, Supply to Lebalelo, Lebalelo to Olifantspoort, De Hoop to Steelpoort, Nebo Plateau and Roossenekal	Limpopo	2018	Design
Dam safety rehabilitation programme	Dams	Rehabilitation of dams and dam safety work	National	2015	Construction
Olifants Doorn River Water Resources Project: Raising of Clanwilliam dam	Dam	Upgrading of the existing dam to stabilize the distortion and the augmentation of water supply to meet increasing demands.	Western Cape	2016	Design
Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) Phases 1 and 2	Pipelines, pump stations, dam	Augmentation of water supply to the new power station(s), extensions of mining activities and fast growing population in the area.	Limpopo	2013 (Phase 1) 2020 (Phase 2)	Design
Great Letaba river development project: Tzaneen dam raising (Phase II) and Nwamitwa dam (Phase III)	Dam, water treatment plant, pipelines, reservoirs	To meet the projected growing primary supply requirements to the year 2025, to improve the water availability for the riverine ecosystem and to stabilise water availability to the irrigation sector including the establishment of resource poor farmers.	Limpopo	2016	Feasibility (Awaiting environmental authorisation)
Mzimvubu water project	Dam, water treatment plant, pipelines, reservoirs	To anchor the Mzimvubu Development Zone initiative of the Eastern Cape province	Eastern Cape	2018	Prefeasibility
Mkomazi water project: Smithfield dam and delivery tunnel	Dam and water delivery tunnel	To augment the water supply to eThekwini, uMgungundlovu and the surrounding areas	KwaZulu-Natal (KZN)	2020	Feasibility
Mvoti river - iSithundu dam or Welverdiend dam	Dam, pump station, diversion weir	To secure water supply to domestic and industrial users in the Lower Mvoti basin area (Stanger area, KZN)	KZN	2020	Feasibility
Lower Orange river - Vioolsdrift dam	Dam	To increase the yield of the Orange River to cater for increasing demand in the area.	Northern Cape	2020	Prefeasibility
Western Cape Water Supply System Augmentation Project: Voelvlei Supplement scheme and associated works	Dam, abstraction works, pipelines, pumpstation	To augment the water supply to the City of Cape Town and the surrounding areas	Western Cape	2018	Feasibility

Source: Department of Water Affairs Strategic Plan (annual performance plan) 2011/12 to 2013/14

[1] Refers to the type of infrastructure being proposed, for example dam, strategic road, hospital
[2] Refers to the asset being procured or constructed, for example 50 km of road or the number of beds a hospital can hold.
[3] The project stage relates to the implementation readiness of the project, that is whether it is in the identification, feasibility, design, tender or construction phase

for both raw and processed water, which according to the South African Institution of Civil Engineering's (Saice's) Infrastructure Report Card for South Africa 2011, has seen further deterioration, as a result of insufficient maintenance and neglect of ongoing capital renewal; and the construction of new infrastructure to ensure that South Africa maintains a sustainable water supply. A situation that Saice says is likely to become worse before it becomes better.

This said, according to the National Treasury's Budget Review 2011, the DWA plans to initiate 15 large-scale water projects over the next eight years to address water quality and infrastructure backlogs.

Spending at the national level relates mainly to the provision of bulk water infrastructure. Investment in water services is expected to increase from R9.9-billion in 2011/12 to R10.9-billion in 2013/14. This includes an additional R3.6-billion allocated to the DWA over the medium-term expenditure framework period, of which R1-billion is for the completion of the De Hoop dam and bulk distribution pipelines, R952-million for regional bulk infrastructure, R520-million for the completion of the 78 km Nandoni pipeline, R450-million for emergency drought relief in the Nelson Mandela Bay metropolitan municipality, and R225-million for addressing AMD and its consequences in Gauteng. Further, R1.2-billion has been added to local government's equitable share to support local government delivery.

The DWA has also awarded a R2.2-billion contract for the construction of the 42-m-high Spring Grove dam, on the Mooi Nooi river, near Rosetta, in KwaZulu-Natal, with a storage capacity of 142-million cubic metres, and the department will spend in the region of R91.2-million this financial year to raise the Hazelmere dam to augment the water supply to Umgeni Water.

In addition to the infrastructure development that is currently under way, the DWA is also in the process of finalising the planning and preparation for the construction of other dams and related infrastructure.

These include the construction of a pipeline from the Flag Boshielo dam to Mokopane and nearby communities, in Limpopo; the completion of feasibility studies of and designs for the Umzimvubu and Foxwood dams, in the Eastern Cape; the construction of bulk distribution pipelines and reticulation networks from the Jozini dam, in KwaZulu-Natal; as well as the Groot Letaba augmentation project, comprising the raising of the Tzaneen dam, the finalisation of the plans for the construction of the N'wamitwa dam and the associated water treatment plants and bulk distribution pipelines.

The DWA is also in advanced negotiations for a joint agreement with the government of Lesotho for the implementation of the second phase of the Lesotho Highlands water project, which will augment the Vaal river system that supplies water to Gauteng and the surrounding areas.

In addition, the Trans-Caledon Tunnel Authority (TCTA), which reports to the DWA, has procured funding to implement the Mokolo and Crocodile river west water augmentation project phases 1 and 2, in Limpopo, with a total cost of about R2-billion, to deliver water to Eskom's new Medupi power station and other industries, as well as domestic water to the Lephalale local municipality.

WATER PRICING

Traditionally, water has been regarded as a free resource. Any costs for water are usually associated with the cost of processing and delivery alone, rather than allocating any intrinsic value to the resource. It has been argued that, without a satisfactory pricing mechanism, consumers have no motivation to use water more efficiently, as they receive no indication of its relative value on the market. Thus, there is growing interest internationally in the use of water pricing to curb demand, as well as to generate revenue to cover the cost of providing water supplies and maintaining infrastructure.

Many academics and policymakers have recommended that the price of water be rationalised, allowing costs of development and delivery to be passed to users.

As outlined above, the DWA is expected to spend billions on water infrastructure projects over the next three years. However, some analysts, in accordance with international trends, believe that South Africa's pricing of water should reflect the cost of the infrastructure required to deliver the resource, with such pricing policies required to come into play over the medium to long term, as well as be reflected in integrated national plans. TCTA business analyst Richard Holden argues that, if consumers do not pay the proper price for water, improvements in the sector will never be realised.

Further, the DWA reports in its Strategic Plan that it is working on a revised raw water pricing strategy and expects investigations into the socioeconomic impact of the revision of the pricing strategy to begin in 2011/12,

Economic accounting for water

According to a study produced for the Southern African Development Community by France-based civil engineering and consulting company Egis Bceom International, economic accounting for water (EAW) is one of the tools that could aid better water management in Southern Africa, as the region's water resources come under pressure from a growing population, climate change and rising industrial and agricultural use.

EAW provides a comprehensive framework that allows for the analysis of the contribution of water to the economy and the impact of economic activities on water resources through abstraction, wastewater discharge, and pollution. It collects and enumerates comprehensive data about water use to understand the value of nonmarketed goods and, in this manner, better appreciates the true significance and contribution of water to the economy.

with public comment and consultation expected in 2012/13 and gazetting of the pricing strategy in 2013/14.

Nedbank chief economist Dennis Dykes contends that the whole water debate needs to advance to a more sophisticated level and that banks should start financing responsible projects and start using credits and derivatives to assist with solutions to the impending water crisis.

The private sector could also play a more prominent role in investments in the water sector.

WATER DEMAND MANAGEMENT AND CONSERVATION

Definition of water demand management

Water demand management as defined by the International Journal of Water Resources Development is any method – whether technical, economic, administrative, financial or social – that will achieve one or more of these objectives:

- lower the quantity or quality of water needed to accomplish a specific task;
- modify the nature of the task or the way it is undertaken so that it can be achieved with less water or with lower-quality water;
- lessen the loss in quantity or quality of water as it flows from source, through use to disposal;
- alter water use from peak to off-peak periods; and
- improve the ability of the water system to continue to serve the population during times when water is in short supply.

South Africa's water demand is expected to rise by 52% within the next 30 years and, while increasing water demand associated with high economic and population growth will require South Africa to increase its storage capacity through construction of new facilities, it will also require the country to practice effective water demand management that, up until now, has been described by some as "a dismal failure", when considering the loss of water through leakages, inefficiencies and theft of water from rivers.

University of KwaZulu-Natal hydrology emeritus professor Roland Schulze argues that, while South Africa's integrated water management approach as enshrined in the National Water Act is impressive on paper, aiming to deal with the socioeconomic, technical, financial, institutional and environmental issues as they pertain to water, and serving as a framework to ensure sustainable use and development of water resources, the policies are not being implemented at a practical level.

Saice water division chairperson Dr Chris Herold further argues that "Undue vacillation on the part of municipal decision-makers appears to have played a major role in the failure to achieve water demand management", placing not only national water supply systems at risk, but also proving extremely short-sighted given the large economic advantage to be gained by municipalities from curtailing the water losses.

Minister in the Presidency responsible for National Planning Trevor Manuel also commented on this issue in the National Planning Commission's Diagnostic report released in June this year, saying: "While the national resource planning process has identified the supply needs and management alternatives in an increasing number of cases, this knowledge is not being translated into timely action". The Minister went on to say that the delay in producing the second edition of the National Water Resource Strategy, setting out key water challenges and proposed responses, which is supposed to be produced every five years, is "symptomatic" of this.

To add insult to injury, South Africa is "losing professional expertise and institutional memory at an alarming rate", with Dr Chris Herold arguing that in 2007, only 37% of engineering posts within the DWA were filled. The figure is said to have worsened since then. Compounding the brain drain is the fact that too few young water engineering professionals are entering the industry.

This is worrying, as South African Irrigation Institute president Jaco Burger believes that the greater the demand for water becomes, the more relevant professional people in the industry will become and the greater the pressure on these professionals will be to find unique solutions for unique local water challenges and problems.

It is further believed that South Africa will continue to face water challenges until perceptions about water use and reuse change, and that more attention should be given to preventing water pollution, rather than thinking of ways to clean polluted water, with industry being highlighted as one of the main culprits of water pollution and unnecessary water wastage in the country.

According to Siemens Water technologies VP for food and beverage industries Mitch Summerfield, technology is available for companies to implement more sustainable water practices and use recycled or reuse water (grey water) in their products; however, companies struggle with the notion of using grey water in their products.

Public perceptions on recycled/reused water are deeply ingrained. Anthony Turton has argued for treated sewage to be used as a new source of potable water in South Africa, as is successfully being implemented in Singapore, but says that local perceptions and lack of water education bar such progress in the country.

This is not to say that there has not been progress in water demand management and conservation. For instance, drought relief interventions, amounting to R31-million in 2010, prevented the drought-stricken Ndlambe local municipality, in the Eastern Cape, from experiencing water shortages during peak demand season for the first time in more than five years. Provincial water utility Amatola Water, together with the municipality, implemented 11 projects using six interventions to alleviate the drought situation in the area.

These included public awareness, targeting high water users, building new and refurbishing old infrastructure, the resuscitation of the sand dunes well at Port Alfred's East Beach, water conservation and demand management, the upgrade of the bulk water pipeline from Port Alfred to Bathurst and maintenance. Amatola Water also installed bulk water meters to monitor water use.

eThekwini Water and Sanitation projects, KwaZulu-Natal, South Africa.

The eThekwini water and sanitation projects include a Water and Sanitation (W&S) project, an Asbestos-Cement (AC) water pipe replacement project and the Western Aqueduct (WA) project.

The W&S project aims to provide infrastructure from water and sewer links throughout the province, to ablution blocks in 317 informal settlements selected for future development by the Department of Housing. One prefabricated ablution block, with water and sewer links, will be installed for every settlement comprising more than 50 dwellings. About 800 000 people living in 240 000 informal settlements will be given access to running water and toilet facilities.

The AC water pipe replacement project entailed the replacement of 1 600 km of eThekwini municipality's old undipped AC water pipes between Tongaat, Umkomaas and Cato Ridge. These water mains had reached the end of their economic life, resulting in bursts that inconvenienced consumers and damaged property. In most areas the old burst-prone pipes were replaced with modified polyvinyl chloride (mPVC) pipes. However, in the central business district, high-density polyethylene (HDPE) pipes were used, as this type of material was found to be more suited to the trenchless technology methods used in these areas. The new mPVC and HDPE pipes have an estimated 50-year lifespan. The project is expected to reduce water loss by an estimated 10.6%, which translates into a saving of about R248-million a year. The municipality aims to reduce leaks each year so that, within ten years, the water loss can be kept at 23%.

The WA project comprises about 74 km of steel pipes welded in 18 m sections, with diameters ranging from 0.5 m and 1.6 m, laid from Umlaas road to Ntuzuma, mostly along a route that traverses urban areas within the existing pipeline servitudes and road reserves. This project will add further capacity of 400-million litres of water a day to the current consumption of the city, which stands at 1.1-million litres a day.

As an offshoot of the pipeline project, excess pressure contained in the pipeline will be converted into hydropower by building two electrical generators along the pipeline route that will generate a total of 10 MW. The first 20 km of phase 1 of the project, which will be commissioned soon, runs from Umlaas road, near Pietermaritzburg, to the Inchanga railway station, generally along a route parallel to the N3 freeway. Phase 2 will run from Inchanga station, crossing Drummond, Assegai and Hillcrest, and will then follow close to the M13 freeway through Everton and Kloof heading towards Ntuzuma through Wyebank, and branching through New Germany to Mount Moriah reservoir in the Mountain Ridge suburb. There will also be a branch feed to Haygarth road, in Kloof, heading to Tshelimnyama. Phase 2, which will run 55 km, will be divided into six construction sectors, and construction activities are expected to take place simultaneously on each of these sectors, over a construction period of four years.

Value

The W&S project currently has a budget of R396-million, of which R132-million was spent between January 2009 and June 2010. Some R129-million has been budgeted for the 2010/2011 financial year, with the balance allocated to the 2011/12 financial year.

The AC pipe replacement project was initially valued at R850-million; however, it increased to R1.6-billion as the scope of the work expanded. The cost of the project will be recovered in about nine years, as water loss from the old infrastructure decreases, after the installation of the new pipes.

Phase 1 of the WA project is estimated at R150-million, and phase 2 is valued at about R865-million. The cost of the steel pipe is valued at R215-million and the cost of the supply and delivery of valves is R32-million. This brings the total value of the WA project to just over R1.25-billion.

Duration

The W&S project is programmed to reach completion by December 2011.

The AC pipe replacement project started in July 2007 and was completed in June 2010.
Phase 1 of the WA project, which started in January 2009, was completed in February 2011. The tender award for the construction of phase 2 has been delayed, owing to objections lodged against the eThekwini municipality's decision to award the contract to an EsorFranki/Cycad Construction joint venture (JV). This final stage of the project is expected to enter full service by early 2015.

Latest Developments

June 2011

The official awarding of the tender for the construction of phase 2 of eThekwini Water and Sanitation's R950-million WA project has been delayed.

Three objections have been filed against the decision by the eThekwini municipality to award the construction contract to the Esorfranki/Cycad Construction JV.

As a result, further work on this project has been halted. The procurement and legal departments of the municipality are currently working in conjunction with EWS to formulate an official reply to these objections and hope to soon settle the award disputes. Until this matter has been resolved, no work will proceed on the construction of this phase of the project.

In KwaZulu-Natal, the Msunduzi municipality is investing nearly R22.1-million to reduce the high incidence of water leaks in its reticulation system. This is the first phase of a high-impact water conservation and water demand management initiative that is expected to boost service delivery and halve water leaks over the next three years.

Phase one began in December 2010. Its priorities include repairing all leaking reservoirs and improving reservoir security, as well as ensuring that all key infrastructure is placed on a preventative maintenance programme.

Further, all illegal connections will be identified and regularised by ensuring that all connections are metered, registered and not tampered with. This will, in turn, improve the efficiency of meter readings and billing. During the 2009/10 financial year, 63% of Pietermaritzburg's water was 'nonrevenue' water. Half of this was the result of physical water leaks and bursts, while the remainder was attributed to illegal connections and unmetered or unregistered connections.

In the Western Cape, the provincial DWA has revealed that the province could face dire water shortages within the next six years.

While millions of rands have been spent on infrastructure upgrades and replacements, water metering and water pressure management, among other measures to reduce water losses, the latest Western Cape water supply system study by the department has found that few surface water development options are available "for augmenting water supply to the City of Cape Town and surrounding towns".

One option for the city is to build a desalination plant for which Cape Town is expected to issue a tender for a feasibility study of a large-scale plant in July this year. The desalination study will determine the best location and size for such a plant.

Desalination technologies are deemed the primary technological solutions for meeting global water needs. Modern desalination technologies have applications for the purification of brackish and sea water; however, they can also be useful in eradicating other kinds of dissolved contaminants from impaired waters. The downside to desalination is that it can have negative environmental effects, is quite energy intensive and relatedly, is also expensive.

In addition to the desalination study an investigation will be conducted into the large-scale reuse of water, which is described as the "only remaining major potential source for augmenting the area's water supplies at a lower cost than that of seawater desalination".

The reuse study should also start within the next few months and will run concurrently with investigations into using the Table Mountain Group (TMG) aquifer, which stretches from Port Elizabeth to Cape Town and up to the Cederberg, as well as additional groundwater sources. The city is yet to make a decision on whether to proceed with a pilot well field in the TMG.

Two surface water options are also under review, including pumping winter rainfall runoff from the Berg river to the Voëlvlei dam, as well as diverting winter rainfall, above an agreed threshold, from Michell's Pass to the Klein Berg river and into the Voëlvlei dam.

The department has warned, however, that, while water augmentation is receiving high-level attention, the solutions may not be delivered for years and the short-term focus should, therefore, be on curbing waste and losses.

Another area where South Africa could achieve water savings is in the energy, mining and bulk industrial sectors, which use about 10% of available water. State-owned power utility Eskom's coal-fired power stations require a significant amount of water for cooling. An average wet cooling power station, of which there are still a few operating in the country, requires up to 60-million cubic metres of water a year. As a result, the utility is

South Africa debates hydraulic fracturing

As the Western Cape faces the prospect of a water shortage in the near future, another issue that has been making headlines is the prospect of hydraulic fracturing in the Karoo area of the Western Cape. Hydraulic fracturing, also known as fracking, involves injecting vast amounts of water, together with proppants (sand or ceramic beads) and chemicals into cavities created in the drilling process, the force of which then fractures the rock configurations around it, allowing gas trapped in shale rock to be captured.

Anything from 4-million litres to 30-million litres of water are required to frack a well and a well may be fracked up to 18 times, which could prove challenging in the largely dry Karoo area.

Understandably, environmentalists are less enthusiastic about the potential for shale gas and there seems to be a battle looming in the Karoo, between the locals and the major energy companies looking to develop possible sources of shale gas in the area.

As a result South Africa's Mineral Resources Minister Susan Shabangu confirmed in May this year that her department would not accept any new applications, nor would it finalise any existing ones, to explore for natural gas in the Karoo area until an expert study into the appropriateness of fracking of the region's shale gas resources had been finalised.

The statement followed a Cabinet-backed moratorium on natural gas drilling announced earlier.

The moratorium follows concerns raised by the Treasure the Karoo Action Group (TKAG) to put an "immediate end" to multinational energy group Shell's application to explore and drill for natural gas in the Karoo area. The group urged government not only to put an "immediate end" to applications by Shell and others, but also to prohibit any future fracking prospecting in the Karoo.

The Minister of Water Edna Molewa has also stated that if plans to frack for shale gas in the Karoo are found to have a negative impact on the region's water resources, water licences would not be issued.

The TKAG believes that fracking could result in harm to people and ecosystems, owing to possible contamination of surface water and groundwater.

investigating internal innovations to save water, as well as the possibility of using polluted mine water, which could save up to 6% in five years.

Further, Eskom plans to move away from coal-dependent energy to solar and nuclear energy by 2030. Nuclear power plants can use seawater, if located along the coast, so their demand for fresh water is negligible. Solar power, however, is not as water efficient, requiring in the region of 15-million cubic metres of water a year for a 5 000 MW concentrated power station.

Even with these strides in water demand management, the fact remains that, as water demand increases, South Africa will either have to reuse and/or desalinate water to meet its water needs, or start trading "virtual water" to reduce local usage.

The term virtual water refers, in the context of trade, to the water used in the production of a good or service. For example, by not producing grain locally, and rather importing it, a country could save in the region of 1 000 m^3 of water per ton of grain imported.

Water theft

Water theft and illegal irrigation is a big problem in South Africa, with South African Institution of Civil Engineering's chairperson Dr Chris Herold reporting at the fourteenth South African National Committee of the International Association of Hydrological Sciences Symposium held at the University of KwaZulu-Natal, in September 2009, that some 175-million cubic metres of water a year were being stolen by farmers in the Upper Vaal catchment area, particularly along the Liebenbergsvlei river that serves as the conduit for the transfer of water from Lesotho. According to Herold, the Vaal river system is already in deficit by about 2% and water theft quadruples this to a substantial 8%.

Herold suggests that this crisis has arisen "purely from failure to define water rights, enforce monitoring, interpret readily available information that is collected at great cost, and enforce compliance". A situation, which Herold says clearly speaks of crumbling capacity within the Department of Water Affairs (DWA).

In June this year, however, acting deputy director-general for policy regulation in the DWA Helgaard Muller, told Parliament's Portfolio Committee on Water and Environmental Affairs that new regulations to enforce metering of all forms of water usage would be gazetted soon.

Another area of concern is the number of mines in South Africa operating without valid water licences, which the DWA reported at 100 in June 2011 – four of which had not yet applied for such a licence. This was 25 less than in 2010, but nonetheless brings into question the thoroughness of the process of granting water licences. Further, the DWA reports that since August 2010, five companies have been issued with predirectives or directives for contravention of water licence conditions.

Compounding South Africa's water loss problem is water lost through infrastructure leakage, which, according to some, has reached crisis proportions as municipalities are consistently failing to meet water demand management targets.

The big exporters of virtual water are generally countries with plenty of water, as well as the financial means to exploit the resource efficiently. South Africa's agricultural sector uses 62% of the country's allocated water resources, but the sector only contributes around 3% to GDP, which shows a vast inefficiency in water use. Were South Africa to trade in virtual water the "saved" water could then be used for more productive purposes, for example the mining sector, where the contribution to GDP would be higher per unit of water.

In short, the virtual water trade allows the world's food to be grown where it makes most sense – where there is an abundance of the resource. However, virtual water is not without its drawbacks. There are grave environmental consequences to exporting water. For instance the US' virtual water trade is emptying the Colorado and Rio Grande rivers, with neither river now reaching the ocean for much of the year. Further, the export of water is exhausting what was once the US' largest underground water reserve – the Ogallala aquifer. The aquifer is being depleted faster than it can be replenished by rain.

Also the world's reliance on the virtual water trade creates risks of its own. The trade in water can only go so far and, as more water shortages emerge around the world, virtual water traders will be in short supply.

Nonetheless, should current trends of theft, leakage from aged and poorly maintained municipal infrastructure and the loss of wetlands persist in South Africa, growth in demand will intensify competition for water resources across all sectors of the economy (agriculture, energy, industry and domestic). This will have serious social and political ramifications and will strongly impact the country's plans for economic growth.

Thus, the control of water theft and wasteful practices, as well as continuing essential maintenance and refurbishment, will require long-term political will and the ongoing employment of adequate financial resources.

WATER AND CLIMATE CHANGE

While climate change is not considered to be as dire a threat as the water challenges that have been created, it is generally accepted that water scarcity will be a fundamental developmental constraint to South Africa.

The DWA expects that the net effect of climate change will ultimately reduce the availability of water in the country, although the effects will be disproportionately distributed, with greater variability reflected in bigger and more frequent floods and prolonged periods of drought.

Climate change also presents specific challenges to water infrastructure. As the DWA explains: "More extreme wetting and drying cycles result in greater soil movement and make water and sewerage pipes more prone to cracking. Increases in intense rainfall events will place soil dams at risk and increase siltation of dams and estuaries. Coupled with higher temperatures, intense rainfall effects also cause problems with water quality in terms of colour and odour."

Consequently, the much bigger man-made challenges that have been highlighted in this report will merely be superimposed on the greater risk of system collapse and the necessity to plan that much more effectively.

CONCLUSION

Water is a strategic resource, which is not only necessary for life but also a medium for development. However, across the world, in both developing and developed regions, poor governance and mismanagement of natural resources, in addition to rising population growth, ever-increasing urbanisation, and economic development, have led to a disproportionate imbalance between water supply and demand.

The growing demand for water worldwide has already created serious water shortages in some areas or will limit the availability of water to people, agriculture, industry, and/or the environment in the future.

Waning water quality is further restricting this diminishing supply of clean water. Already lack of access to safe, clean water for drinking, sanitation, agriculture or industry is responsible for cycles of poverty and limiting practical development options in regions around the world.

The water supply and quality issues noted in this report reflect a miniscule proportion of a fast-growing body of knowledge relating to water services and water quality not only in South Africa but in Africa and the world at large.

In South Africa, it is generally believed that enough water can be made available at all major urban and industrial growth points in the country for supply not to be a limiting factor to economic development. However, given the long lead times for developing new supply schemes, cooperative planning will be required between water users and water management institutions to ensure that water can be made available when it is needed.

The challenge is not just about water quantity, but is also about water quality. In South Africa, several analysts have advocated a coordinated approach to improve water quality, especially in line with the country's social and economic priorities, such as food security, the development of a green economy and meaningful job creation.

This will require policy makers to go beyond the areas that are normally considered 'water business', which will involve major changes in the way that other sectors – water supply and sanitation, agriculture, energy, industry and human settlements – are managed and weighed up against each other.

The DWA has acknowledged this and, in May this year, the department launched a major partnership with the private sector at the World Economic Forum on Africa. This pioneering public–private partnership is aimed at addressing the challenges of closing the breach between water demand and supply that is projected to reach 17% in South Africa by 2030. This will assist in preventing reactive responses, which are likely to be less successful and more detrimental to the environment.

On a global level, water security will require policies and plans for this resource to be incorporated into national and international development processes. It will also require that world leaders, governments and funding agencies appreciate that, in the long term, investment in water is an opportunity and a solution to sustainable social and economic development.

Should sustainable measures not be instituted to address water security issues they have the potential to cause instability and even territorial conflict within countries, between countries or even across entire regions.

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South Africa's water sector 2011

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