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DEPARTMENT OF WATER AFFAIRS AND FORESTRY

Strategic Framework on Water for Sustainable Growth and Development

Discussion Document

April 2008

REQUEST FOR COMMENT

All stakeholders are invited to comment on this strategy discussion document. Comments are to reach Ms Shantal Harigobin (**HarigobinS@dwaf.gov.za**) or Ms Jabu Mtolo (**MtoloJa@dwaf.gov.za**) ***not later than 30 May 2008***.

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Queries can be taken up with Ms Jabu Mtolo on 012-336-8943

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1 Introduction

South Africa has made remarkable achievements in providing safe drinking water to people, and in ensuring that there is sufficient water for energy generation and for the growth of the industrial, mining, agricultural and other economic sectors. But it would be foolish for the water sector to become complacent because of these achievements. The failures in the South African electricity sector, and failures in water provision around the world, raise the warning that things can, and do, go wrong. As with the provision of electricity, the lead time for the construction of large infrastructure is long, and planning must be farsighted and proactive. As with electricity generation, poor maintenance and deferred decisions can have enormous impacts on the economy and on people.

It is ten years since the promulgation of the internationally recognized National Water Act, and eleven years since the promulgation of the Water Services Act. These pieces of legislation are currently under revision, after a decade of implementation experience, and a decade of institutional change and development. However, legislative reform is not sufficient at this point. The water sector needs to look hard at it performance, to identify its weaknesses and failures, and to find new and better ways of doing things to ensure that now, and in the future, there is sufficient water to support sustainable economic growth and social development.

This strategy discussion document sets out some of the challenges facing government and the water sector in ensuring that water is used optimally in support of sustainable and pro-poor growth and development. There are several factors that require the water sector to review its performance. The first is that, despite 14 years of democratic rule, poverty is still a scourge in our country, particularly in the former 'homeland's, and particularly within black communities. The second is that global climate change is impacting on rainfall, temperature, and rates of evaporation, changing the historical patterns of how much water is available, in which areas, and over what time. Other factors include economic growth, urbanization, rising living standards for many, and deteriorating water quality. A very positive driver of change is the widespread availability of groundwater which has been severely underutilized to date. This strategy discussion document highlights these drivers of change, and the opportunities for doing things better or differently.

The strategy also highlights that we should not only look for new opportunities to provide water, new dams, inter-basin transfers or desalination plants, particularly as climate change intensifies. Important as these are, there is an equally weighty challenge in maintaining our current infrastructure in good working order. The public water sector has over R220 billion in assets, in dams, bulk conveyance systems, treatment plants and reticulation systems. Keeping these existing assets functioning optimally is crucial to the achievement of economic growth and poverty eradication. If this foundation fails, the economic and social impacts will be severe.

Poor maintenance and management of existing assets is already giving rise to water quality problems and extremely high levels of water wastage. There are issues of allocation between sectors, pricing, and compliance with water use requirements. The strategy discussion document raises these and potential obstacles to meeting sector objectives in supporting economic and social growth and development. These are raised not as challenges, but as opportunities for change and for doing things better.

The strategy discussion document is structured as follows:

- ***Drivers for change*** outlines what is driving the need to find different and better ways of managing water.
- ***Setting the picture*** describes the current water situation in South Africa, in relation to water availability, water services delivery, climate change and regional development. It examines the role of water in the economy, in social development and the environmental value of water.
- ***Opportunities for change*** explores ways of overcoming key challenges and obstacles that may constrain the water sector from contributing effectively to growth and development. The issues have been clustered into six key areas: risk and adaptive management; investing in people; infrastructure; finance and pricing; institutional issues and integrated planning.
- The final section on ***Actions and targets*** has been left open, as the process of consultation over the next two months will identify actions and targets from within and beyond the water sector.

This strategy discussion document reflects on current challenges and opportunities, as an opportunity to consolidate gains made, make adjustments where warranted, and broaden our vision to tackle new challenges that lie ahead. It stresses the importance of strengthening alignment across government, particularly where policy and planning impact on water supply and management.

The National Water Resources Strategy (NWRS) must be revised for publication by late 2009. The Strategy for Water for Sustainable Growth and Development will form an over-arching document that will provide guidance to the direction of the revised NWRS. The scope of the NWRS must be broader than the first edition, to address more effectively the interface between water services and water resources management. Similarly, any possible amendments to the Strategic Framework for Water Services will be guided by this strategy.

2 Drivers of change:

This section outlines the key drivers that require the water sector, and those dependent on water, to review current performance critically and to find new and better ways of managing water.

2.1 *Changing climate and hydrology (uncertainty)*

The key physical drivers of South Africa's changing water resources situation include climate change, and changing land use and degradation. High levels of uncertainty are associated with this change. Climate change impacts on rainfall and evaporation, while land-use and degradation changes the way that water resources function. Together, these are resulting in an increasingly uncertain and unpredictable water resources environment, which poses significant challenges and constraints to economic and social processes in South Africa. This calls for the development of extensive capacity to adapt for resilience.

2.1.1 *Global Climate Change*

South Africa's future climate is likely to be warmer, influencing both rainfall and evapo-transpiration. Figure 1 below shows temperature projections which suggest a 1^0 to 3^0C increase in temperature by 2050, with the greatest increases in the interior. Predictions for rainfall changes are less clear, except for the Western Cape, where rainfall could be reduced by 5% to 30%.

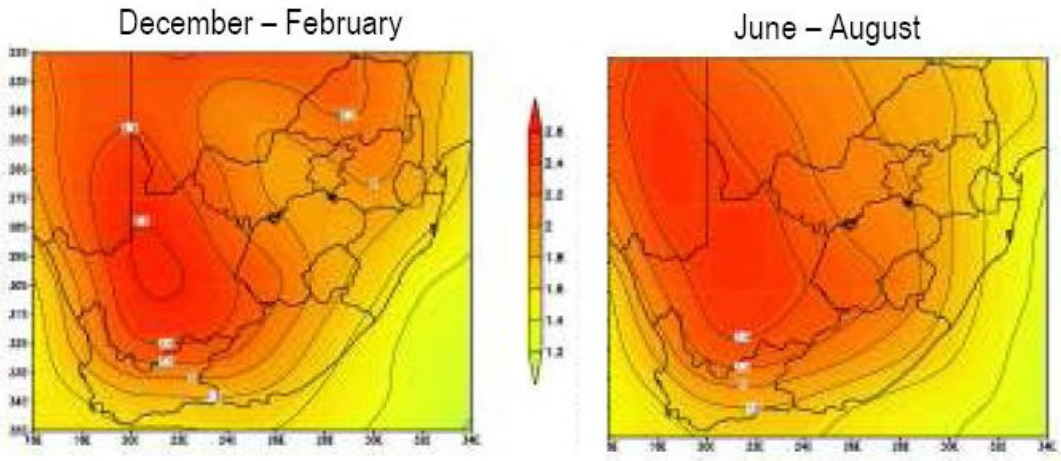


Figure 1: Projected median change in maximum surface temperature for the summer and winter seasons by ~2050. Source LTMS, 2007.

Figure 2 below shows the latest rainfall modeling which suggests that the northern and eastern regions of the country may get wetter, especially in the steep areas around the escarpment. The western and southern regions are likely to get drier. The models suggest longer droughts and more severe storm events and floods.

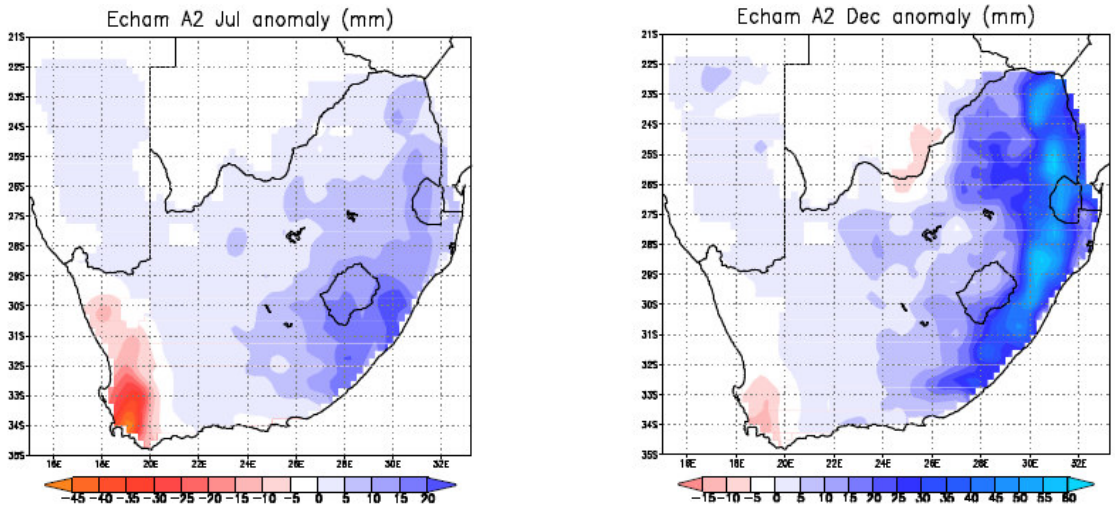


Figure 2: Projected change in total annual rainfall (mm month^{-1}) for July and December from a new generation GCM used in the most recent IPCC assessment. Source: LTMS, 2007.

The changes in temperature and rainfall will have significant impacts on water availability. Increased temperature will increase evaporation from dams, reduce soil moisture and increase demand for water for irrigation.

Changes in run-off and increased evapo-transpiration will affect water storage. The drier parts of the country, including areas where some of our most important dams are located, may see lower dam levels with reduced storage, while in the wetter parts of the country, lower dam levels in drought years may be balanced by higher levels of storage in wet years. It is clear that South Africa will experience more extreme floods and droughts. What is less clear is how, when and where these will occur.

Thus, climate change will result in significant changes in future water availability, with major implications for most sectors of the economy. It will also become increasingly difficult for water resources planners to plan effectively, as past trends and historical water data become increasingly irrelevant. The challenge then becomes one of planning for uncertainty. Substantial investments will be required in water infrastructure and water management strategies to manage and mitigate the consequences of climate change and bolster our resilience. Technical and economic efficiency, and technological innovation, are central to such resilience. This is likely to require significant shifts in allocation and increases in water pricing.

These changes mean our water resources management systems must develop the capacity to adapt, to enable rapid and effective responses to increasing climate variability. This matters more than being able to predict climate changes and their impact on water resources accurately.

2.1.2 *Land use change and deterioration*

Changing land-use practices compound these climate change effects and uncertainties. Social, political and economic processes that drive expansion or contraction of

irrigated agriculture and stream-flow reduction activities, technological advances that increase efficiency of production and water use, and global macro-economic processes (such as the cost of oil and the focus on bio-fuels) are key drivers of change and uncertainty in future land-use patterns in South Africa. Land degradation and the loss of ecosystem services may be human-induced (agriculture, overgrazing, pollution) or physical (climate change, fire, desertification, alien invasive species).

Land-use and degradation impacts on water resources include:

- changes in run-off and infiltration that lead to flood events and reduced groundwater recharge;
- increased sediment in reservoirs, rivers and estuaries, linked to loss of top-soil;
- increased pollution, particularly through non-point source run-off; and
- ecosystem changes that reduce the resilience of the system and assimilative capacity.

While not directly the mandate of water managers, these land use changes have profound impacts on water resources and their use. They therefore require attention for effective water management, with coherence in government and corporate planning around the future availability and requirements for water in South Africa.

2.2 *Groundwater use*

Increased scope for groundwater use presents an enormous opportunity in South Africa. Water resources management has, historically, been focused on the management of surface water, resulting in an extensive network of dams, inter-basin transfers, and pipelines. Recent work by the groundwater community has shown that there are significant reserves of groundwater that are not being utilized. Poor management and lack of knowledge in the past has led to only a small portion of South Africa's groundwater potential being exploited.

The potential availability of groundwater has impacts on the amount of water available for growth and development, the infrastructure requirements for accessing this water, and the management capacity for ensuring sustainable use of this water. It also has implications in relation to planning at the municipal and national levels. Historically, groundwater has been seen as a suitable local source for rural communities in particular. What the new studies suggest is that it may be a major and sustainable source of water that can be used much more widely for a range of purposes.

In the light of global climate change, the use of groundwater is particularly important because it is less vulnerable to evaporation as a consequence of rising temperatures. Underground storage capacity in aquifers also offers good potential for harvesting run-off as a result of increased storm events. Artificial recharge of aquifers is an important avenue for investigation and implementation, both to improve borehole yields and reliability and to increase underground water storage. Underground storage can be developed, incrementally, at a far lower cost than surface storage systems.

2.3 *Changing water use patterns*

2.3.1 *Economic growth*

The strategic response to ensuring that we have sufficient water to supply a growing economy is to encourage shifts towards water uses that generate more GDP and jobs per drop. However, making water available for 'higher value' sectors will not necessarily promote their growth. On the other hand, an unreliable water supply may well inhibit growth, and countries which have developed and managed water infrastructure to increase the reliability of supply have been able to better respond to economic growth stimuli.

External economic drivers play an important role in shifting water use patterns. As such, while government can proactively reallocate water, ultimately water use patterns are driven by factors outside of the water sector. During, the 19th century the economy, and consequently water use demands, were primarily driven by agriculture. Throughout the 20th century shifts towards mining, and over the last 30-40 years, increasing industrialisation, saw more water going to these sectors and to growing cities. The largest water use sector has, however, remained irrigated agriculture.

While irrigated agriculture is likely to remain the dominant water user for some time, we may see shifts in the nature of this use. Improved irrigation efficiency and shifts toward less thirsty crops may see improved crop and jobs per drop in this sector, while strong economic growth may see the uptake of this water by municipal and industrial users. High global oil prices are making bio fuels an increasingly attractive economic prospect. Bio fuel crops will increase demands on water supplies.

At least for the near future, much of the increasing demand could be supported by improved water use efficiency and from groundwater.

While growth in the mining, industrial, and more recently services sectors, has not yet changed water use patterns significantly, it has had major impacts on water quality. The quality and ecological health of many of our river systems in, and downstream of, large mining, industrial and urban centres has deteriorated over the last few decades. Water quality impacts on groundwater are a particular concern because of the difficulties in rehabilitating polluted groundwater.

2.3.2 *Migration and Demographic Change*

Service delivery in 21st South Africa must grapple with a range of complex dynamics and challenges: chronic poverty among at least 46% of the population; a significant number of people who continue to straddle rural and urban livelihoods strategies, and require housing and services in more than one place; growing informal settlements on the margins of towns of all sizes; questions about the amount of free basic water that should be provided to needy and vulnerable households; and service options that meet the needs of poor people, as swiftly and affordably as possible.

Post-apartheid migration in South Africa has increased substantially, with a significant rise in the proportion of women migrants. Many migrants settle permanently in towns, but a significant proportion continues to move back and forth between a rural base and livelihoods opportunities elsewhere. While job prospects in urban areas are limited, they tend to offer benefits not available in rural areas: the possibility of work, informal trading opportunities, and better access to schools, health care and services.

Migrancy reflects high levels of social disruption, which increases vulnerability to HIV / AIDS. But HIV / AIDS also contributes to migrancy, as people seek access to health services or income opportunities to mitigate the impacts of HIV AIDS, and as people go home to be cared for by their families.

South Africa's rate of population growth is slowing, in part because of the number of people dying from AIDS. Average household size is declining, in part because growing access to social grants means that more people can afford to establish a separate household. There has been a significant rise in the number of households since the 1996 census, and in the number of households needing housing and services.

The highest prevalence of HIV/AIDS is in informal settlements, followed by urban areas and dense rural settlements. Service deficiencies are most acute in informal settlements, and these areas are frequently the most complex to service because of their density and location.

HIV/AIDS has enormous implications for delivery of water services. People with compromised immune systems are particularly susceptible to water-related diseases; they are prone to diarrhoea, and need close access to adequate sanitation and water; care-givers need additional water to cope with increased laundry and to support good hygiene and care; and households affected by AIDS frequently have reduced incomes, which affects their ability to pay for services.

Amongst the poor, it is women who bear the brunt of poor services - the work of fetching water, with backache from carrying heavy containers, time costs of queuing, the added work of caring for sick family members, the indignity of bad sanitation, safety risks after dark. It is women who benefit most from good services.

2.3.3 *Redress, Equity and Post-apartheid conditions*

Access to, and use of water, is still highly skewed along racial lines. While government has made significant progress in providing basic water and sanitation to the poor, much still has to be done to redress inequities in water supply and sanitation and access to water for productive purposes. There are growing calls for free basic water to be increased beyond 6 kl per household per month. Experiences from Bushbuck Ridge have suggested that increasing the amount of water supplied can stimulate a range of local entrepreneurial activities from hair salons to brick-making. Many argue that 'basic needs' should accommodate the water required to support livelihoods strategies, including small scale market gardening.

The momentum of water allocation reform is growing, and interventions to make water available for productive use for previously excluded groups are being initiated. Much of this is likely to see an increase in the demands for irrigation water from black farmers. Similarly, efforts to revitalize irrigation schemes in the ex-homelands areas are increasing. Often, land reform cannot deliver its intended benefits without secure water. Where land without a water entitlement is transferred, water may have to be allocated to the beneficiaries. Many agri-industries and food retailers are actively pursuing redress initiatives in their raw materials suppliers – to help support their own growth initiatives.

In some cases the water required by these new initiatives is already available or has been set aside, but in others this water must be made available by either sharing existing water supplies with other users, or by increased storage. The potential to exploit as yet unused groundwater sources presents an exciting opportunity in this regard.

2.4 *Changing Water Management Challenges*

In addition to potential changes in hydrology and water use, there will continue to be changes in water infrastructure at all levels and in the health of water resources upon which all other users depend.

2.4.1 *Aging and poorly maintained infrastructure*

Much of South Africa's water storage distribution and monitoring infrastructure, as well as water and waste water distribution systems, is aging and needs refurbishment or replacement. A history of poor investment in preventative maintenance has left a significant maintenance backlog in many areas. Local government is, nevertheless, facing increasing demands for high levels of services, which are often unaffordable, exacerbating investment backlogs. Poor cost recovery and water losses also contribute to poor investment in infrastructure maintenance. Poor maintenance of these systems is therefore leading to periodic and sometimes systemic failure, resulting in serious pollution, and often water supply failures.

Similar water infrastructure failure in Ghana has precipitated a water crisis in the cities, in spite of abundant water in the Volga Lake. This has forced many people back to polluted rivers in urban centers for their basic water needs, causing massive outbreaks of water borne diseases. This has become a major political issue for Ghana. Already, South Africa is showing some signs of similar problems, which may underlie the water and economic growth nexus into the future.

Moreover, while more efficient use of water can offset some of the increased demand for water brought on by economic growth, ultimately the country will have to invest in additional water storage infrastructure, and, importantly, in additional infrastructure for exploitation of groundwater.

2.4.2 *Decreasing water resource quality*

Increased water demands from a growing middle class, growing industrial and mining use, and failing water and waste infrastructure have had considerable impacts on water quality. Faecal contamination, growth of algae in rivers, increasing salinity and sediment wash off to surface waters have had widespread impacts, while radioactive contamination, heavy metals and persistent organic pesticides (POPs) have had more localized impacts.

Poor water quality not only increases the cost of treating water to potable standards, but increases the costs of using water in industry, can lower the efficiency of water use in agriculture, and in the worst cases results in lower water availability due to dilution requirements. Most importantly, deteriorating water quality increases human health problems, particularly in areas where people may use untreated or poorly treated water for household purposes.

As water quality deteriorates, stream flows decrease and riparian activities increase, the ability of the freshwater ecosystems to attenuate floods and assimilate waste decreases, resulting in a negatively reinforcing spiral. This process may be exacerbated by climate and land use change thereby further reducing the resilience of the system.

Despite these possibilities, the state of South Africa's freshwater systems is generally acceptable, albeit with severe threats around the most populous and urbanized parts of the country. However, there is a general deterioration of this resource quality that needs to be stabilized if the abovementioned scenario is to be prevented.

2.5 *Changing Institutional Arrangements*

All these external drivers are creating new challenges for water management. New skills are needed to manage changing water resources, environmental and economic growth paradigms. Our ability to engage these challenges depends on the strength of our water management institutions.

However, the institutional environment for water management has been in considerable flux since 1994. The delegation of water services responsibilities to local government has created new challenges. The introduction of Catchment Management Agencies (CMAs) has been a difficult and protracted process which has prompted a reevaluation of these institutions. The reform of water boards, not only to reflect transformation needs, but also to reflect a revised role as bulk water services suppliers has also changed the playing field, while the proposed establishment of a National Water Resources Infrastructure Agency is introducing a new player to the sector.

The dynamic nature of the water and water services management institutional environment has therefore added to the complexity of our challenges and to the way in which the water sector responds to water for growth and development.

3 Setting the picture

This section describes current water availability in South Africa, the provision of water services, the economic and social aspects of water, and the contribution of water resource quality to social and economic development and highlights some of the challenges facing the country in relation to water for sustainable growth and development.

3.1 *Water availability*

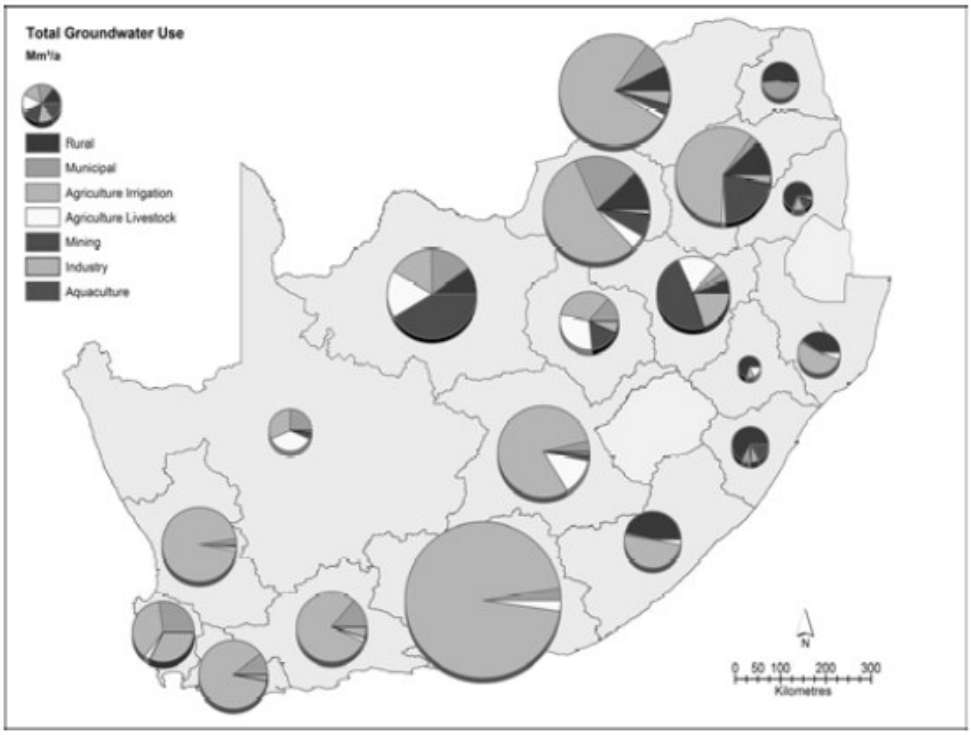
South Africa has low rainfall by international standards – just 60% of the world average - and one of the lowest ratios of Mean Annual Precipitation (MAR) to Mean Annual Run-off (MAR) in the world. Just 9% of rainfall reaches rivers, compared to an average 31% worldwide (DWAF, 1996). Rainfall is generally higher in the north and east, and decreases significantly in the south and west. Rainfall is highly seasonal, and there is high variability from year to year, with the spectre of drought always present. The result is high levels of variability in river levels and dam storage over time, and high variability in groundwater levels.

South Africa has developed sophisticated surface water infrastructure to optimize available water resources through storage systems and inter-basin transfer schemes; water from the Orange River system now flows into the Limpopo, and most catchments are linked to a degree that is unusual elsewhere. These bold engineering schemes provide a high degree of water security relative to available resources, so that South Africa can claim to have 'structurally-induced relative water abundance'. Tunnels, pipelines and canals transport water over long distances, and redistribute it from areas of relative abundance to areas of relative scarcity. But South Africa is approaching full utilisation of available surface water yields, and is running out of suitable sites for new dams.

The focus on surface water means that South Africa has underexploited its groundwater reserves. New data indicates that there is enormous potential to use groundwater to meet rising water demand. About 15% of South Africa's total water utilisation is currently sourced from groundwater, but rigorous investigation over the past decade suggests that a huge proportion of the country's utilisable groundwater potential is untapped. This is very good news for South Africa's water security, particularly given concerns about climate change and increased evaporation from surface water sources.

Attempts to quantify groundwater resources and their sustainable yields were often compromised by lack of suitable data. Even so, many parts of South Africa rely heavily on groundwater, primarily for irrigation, livestock watering and domestic use.

Figure 3 Groundwater use per Water Management Area



Source: Hughes (2004) in Woodford, Rosewarne & Girman, (2006)

Increased awareness of groundwater potential calls for more sophisticated strategies for catchment management and conjunctive use of ground and surface water, particularly where managed aquifer recharge can be used to increase underground storage. Artificial recharge can contribute significantly towards maximising the use and sustainability of available water resources, and DWAF is promoting it as an integral part of water resource planning and catchment management. It may also be used to safeguard the Reserve, particularly where it is under threat due to large-scale groundwater or surface water abstraction.

Declining water quality in many areas is raising new challenges around the availability of water and the fitness of water for use. Clean water is needed to dilute contaminated return-flows and mitigate the effects of rising salinity and nutrient levels for agricultural and industrial users, particularly in the Vaal river system. Domestic water supplies also face quality and safety challenges, while the poor quality of discharged effluent is contributing to rising eutrophication and bacteriological contamination of rivers and dams, and impacting on the nature of the flows through tunnels, pipelines and canals.

Historically, access to water was highly skewed in favour of the white minority, with massive investment in ambitious engineering schemes to support the development of white agriculture and industry. Access to water continues to confer significant advantages to those who receive it, either through historical water abstraction rights – particularly for farming, mining and industry - or through the convenient access to abundant safe water, while under-development and poverty persist and deepen,

particularly in the ex-homeland areas. Post 1994, Government has given priority to achieving universal access to water and sanitation, and to reforming water allocations, but not enough has been achieved, particularly in providing water for productive purposes to the historically marginalised.

The first edition of the NWRS (September 2004) provides a clear indication of the overall state of the country's water resources:

> "In general, sufficient water can be made available at all significant urban and industrial growth points in the country for water not to be a limiting factor to economic development. However, given the long lead times for developing new supply schemes, co-operative planning will be required between water users and water management institutions to ensure that water can be made available when it is needed."

3.2 *State of water services delivery*

South Africa's water services sector has adopted both the language of human rights, and a policy framework to deliver on these rights. High-level commitment, backed by substantial spending on infrastructure development and servicing subsidies, has led to some extraordinary achievements. DWAF figures[1] indicate that water services infrastructure has been extended to reach 94% of the population, up from 59% in 1994. In the same period, sanitation infrastructure coverage has increased to 71%, up from 48%.

However, there is a tension between provision and ongoing servicing which has played out in a context of concurrent reform in the water sector and the local government sphere. Rapid decentralization of responsibility and funding for provision of water and sanitation occurred in tandem with massive changes in the form and function of local government: integration of racially-distinct municipal administrations, new structures for democratic, accountable government, new systems for improved operational and financial management, and an entirely new conception of the role of local government. One consequence is that national policy objectives have not always aligned with the capability to implement that policy. Another consequence is that the immense water sector gains of the first decade of democracy are at risk, in some areas, of backsliding in the second.

3.2.1 *Extending access*

DWAF figures show that between 1994 and March 2007, 17.5-million people were provided access to improved water supply infrastructure, and at least 86% of people had access to the RDP minimum standard of 25 litres per person per day within 200 metres. Over the same period, the data shows that ten million more people gained access to improved sanitation facilities, raising total access to 71%. This data excludes informal settlements, which are addressed separately through comprehensive settlement upgrading initiatives led by provincial and national Housing departments.

[1] DWAF WS NIS is currently finalizing figures for 2007/08; these will be available from mid-April and can be included in the draft disseminated for public comment.

Consequently, the figures exclude an estimated 15% of the total population[2], which should arguably be included.

Significant backlogs remain in all areas, including the major cities. The most severe backlogs are in the former 'homeland' areas and in the three poorest provinces (KwaZulu-Natal, Limpopo and the Eastern Cape), Nearly half the new infrastructure is in areas with predominantly very poor rural populations, raising critical questions around sustainability, given limited municipal capacity to operate and maintain hundreds of dispersed schemes, and given that the costs of operating many of these schemes are not adequately recovered from either the Equitable Share or user payments. The bulk of the task of eradicating service backlogs and providing free basic water lies primarily with the least resourced municipalities. This has critical implications for institutional reform, and is discussed under Section 3.5.3

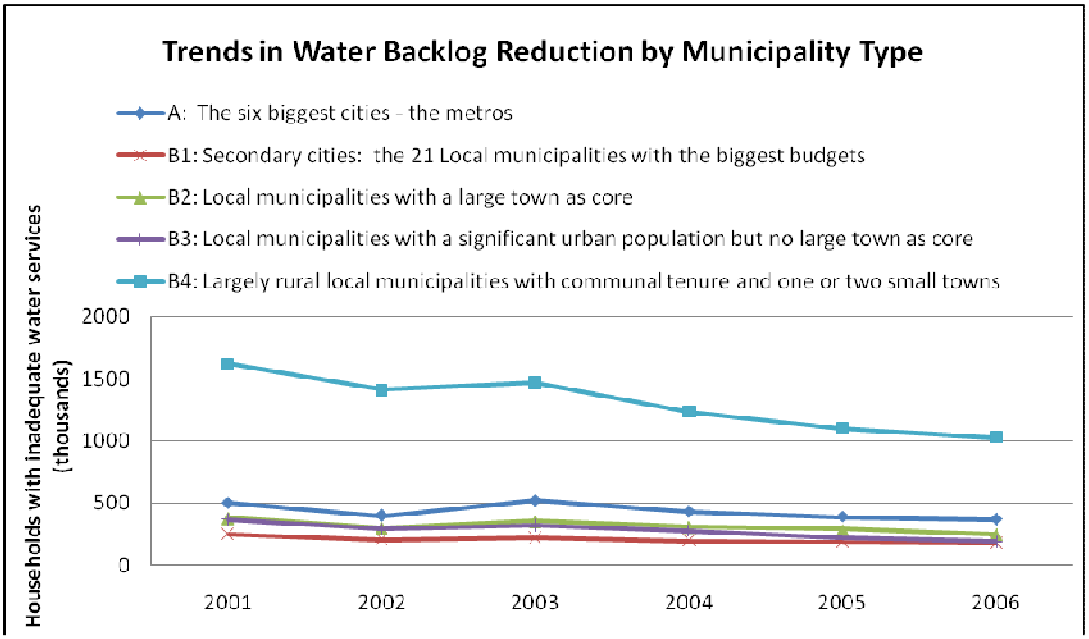


Figure 4: **(DWAF DPLG SALGA 2007: 6)**

Table 1 Distribution of water supply backlogs by municipal sub-category (DWAF DPLG SALGA 2007)

Municipal category	Number of municipalities	Share of Backlog 2001	2006
A	The six biggest cities	16%	17%
B1	Secondary cities: the 21 LMs with the biggest budgets	12%	13%
B2	29 LMs with a large town as core	9%	8%
B3	111 LMs with a significant urban population but no large town as core	11%	10%
B4	70 Largely rural LMs with communal tenure and one or two small towns	52%	52%

[2] DWAF uses a figure of 1.2-m households as the estimated population of informal settlement nationally, which would constitute roughly 10% of households nationally. But the 2007 StatsSA *Community Survey* indicates that 14.5% of people live in informal settlements, which translates to 1.8-m households.

3.2.2 *Free Basic Water*

98% of Water Services Authority are providing free basic water, with 16 claiming to provide FBW to all. The Free Basic Water policy is intended to target poor households, thus the critical percentage is not total coverage nationally (84%), but the proportion of poor households, defined as those with an income below R800 per month, who receive free basic water: 72.75% of those with access to infrastructure. This highlights two key challenges: it is primarily poor households who do not yet have access to basic services, and among those who are served, there are immense difficulties in targeting the poor.

Quality of services
A 'spot-check' audit in 2006/07 by the CSIR on behalf of DWAF of a 10% sample (248 projects) of MIG water and sanitation bulk and household projects showed poor compliance with national policy objectives and construction norms. Just 2.6% of household water projects and 20.7% of bulk water projects met the 95% benchmark, with both scoring poorly in reliability. 13.4% of bulk water projects completed since 2003 had broken down three or more times; 9% of breakdowns took more than a month to repair. 21% of electrical pumps and 14% of diesel pumps were out of order, and a further 57% of diesel pumps lacked fuel. More than 16% of street and yard taps were not working, with a similar percentage damaged. 22.6% of yard taps did not have a water meter, while 16.8% had meters that did not work.

When 77 WSA managers surveyed for the 2007 Masibambane II evaluation were asked whether those who were served would in future be rejoining the backlog queue as a result of defective infrastructure in recently completed projects, 51% said this was happening already. 16% of beneficiaries in settlements with recent water projects said they now had to walk more than 200 meters to fetch water.

A root cause of these failures is the sheer pace and scale of delivery required to meet targets, in a context of a shortage of key personnel. Municipal restructuring has impacted severely on engineering services; along with the rationalization of 847 municipalities to 284, a large number of engineering posts were "rationalized". There are now one seventh of the civil engineering posts in local government that there were in 1990. There is a deficit of about 1 400 municipal engineering professionals, over 3 000 plant operators and a broad range of artisans. Employment equity targets do not align with the pool of available technical staff in South Africa.

3.2.3 *Integrated service delivery*

In their commitment to eradicate water and sanitation backlogs, municipalities are giving priority to extending service coverage, and neglecting sound maintenance of both new and existing schemes; this neglect is eroding municipalities' asset base and compromising their revenue generation and broader economic development prospects. Leaks, bursts and sewer spills are increasing in all areas. Deferred maintenance is costly, for several reasons: the longer it is deferred, the higher the cost of the eventual repair or refurbishment; and the longer that leaks and spills are left unattended, the higher the cost to the municipality of non-revenue water. At least 13% of total municipal water is lost through leaks and spills before the water reaches the customer.

3.2.4 *Drinking water quality and effluent management*

South Africa's drinking water quality has been upheld as among the finest in the world, but these high standards are being compromised in some areas. Expanded service coverage has been accompanied by a rapid increase in the number of water treatment plants nationally, and a growing operation and maintenance load. Many treatment works are staffed by a single operator during office hours only, although the treatment process runs continuously. There have been a number of severe diarrhoea outbreaks from contaminated water and several instances of typhoid – most notably in Delmas where at least 13 people died in 2005.

The 2007 National Benchmarking Initiative revealed decreasing compliance of municipal wastewater treatment samples with minimum standards, and a 'severe, widespread and apparently growing threat to health and the environment'. A 2006 survey of 51 wastewater treatment plants in eight provinces found a critical shortage of trained and skilled staff. Just 4% of the plants surveyed were operated and maintained adequately, and 'immediate intervention" was needed in 30% of works to avoid health crises.

Even fairly low-tech systems are suffering from accumulated neglect and poor operation. A 2006 survey of 47 Free State oxidation ponds revealed that over half were illegally discharging effluent with high faecal coliform loads into local rivers, as a result of poor operation and overloading. DWAF figures (March 2008) show that wastewater treatment in more than half (55%) of the Free State's 87 towns is non-compliant, and requires attention in a further 26%. One contributing factor is the rapid upgrading of bucket toilets to flush systems. Bulk supplies and infrastructure in a number of towns cannot cope with the additional demand for water for flushing, or with the additional load on the sewer system and treatment works; there are several examples of projects where bucket toilets have been removed and replaced by water-borne systems, but where flushing is not possible because there is no water or sewer connection. Household members now have to dispose of their excreta themselves, without the support of a municipal collection service.

3.3 *Government planning*

Government has a national planning framework to guide economic and social development planning, including planning processes at national, provincial and local government level. The intention is that the various plans should talk to each other in an integrated planning framework, which can then be implemented, if necessary, through the mechanisms outlined in the Intergovernmental Relations Act.

The National Spatial Development Perspective provides the principles and mechanisms for guiding infrastructure investment and development decisions describing the spatial manifestations of the main social, economic and environmental trends. It is intended to inform the development plans, policies and programmes of all spheres and agencies of government. At the provincial and local level, Provincial Growth and Development Strategies and Integrated Development Plans are the key planning tools that must reflect the content of the NSDP. The development of these

strategies is based on interaction with a number of different role players, including public and private sectors, to determine the growth and development priorities for a municipality, province or nationally.

3.3.1 *Integrating economic and development planning with water planning*

The key to integrating economic and development planning with water planning is the understanding that water is a limited resource that must be shared between a number of competing functions. Since economic and development plans have water implications, it is be important to cooperate during strategy development in order to avoid developing "dry strategies".

Avoiding "Dry Strategies"
The key objective for the water sector institutions is to ensure that water is available for economic and social development, and to provide strategic advice on water availability as reflected in the various plans. The question that should be interrogated is whether these institutions have clear internal processes that ensure proper engagement with the appropriate plans of other organs of state. As an example, do water services authorities have clear processes for engaging the development of provincial growth and development strategies, or even the economic development plans of their own municipalities. Similar questions pertain to the structured engagement of DWAF and the CMAs with the local, provincial and national economic planning processes. The integrated planning framework is in place - the key question is whether the current systems are working and if not, how they can be improved. Water sector institutions need to understand government planning processes so as to be an active part of these planning processes

The National Water Resource Strategy, a particularly important tool for aligning macro water availability issues with economic and development planning, must be revised by late 2009. The revision of strategy will be done in line with this strategic framework to ensure that water is used optimally to support growth, development and poverty eradication.

The NWRS provides a broad picture of the national water resources, and offers strategies towards equitable, sustainable and efficient use in line with principles set out in the NWA. The detail, however, is not sufficient to inform actual management required in the Water Management Areas (WMAs). This encouraged the preparation of an Internal Strategic Perspective, or ISP, for each WMA. In the ISPs the water resource situation has been analysed to a finer level of detail and provides a far more detailed and intensive situational assessment.

3.4 *Regional development imperatives*

Growth and development is a major challenge in our neighbouring states. Malnutrition in children under 5 ranges from 10% in Swaziland, 12.5% in Botswana, 18% in Lesotho to 26% in Mozambique (World Bank). The challenge of growth and development in these states is thus huge.

A large proportion of South Africa's water resources are shared with neighbouring states, and this water must be shared in a manner that meets the growth and development needs of all riparian states. Namibia's economic growth rate is predicted to reach 4.7% in 2008, while Mozambique's economy grew at 7.9% in 2006 and Botswana's at 4.2%. It can thus be expected that the water needs of these states will increase, even as South Africa's water demands are increasing. Equally, increasing economic activity in South Africa and in the neighbouring states is likely to result in increasing pollution challenges in shared rivers and aquifers. This is happening in a context of increasing regional economic integration.

SADC has developed and is implementing the *Regional Indicative Strategic Development Plan* (RISDP), which highlights that poverty is "one of the major development challenges facing the SADC region". Priority is given, in the RISDP, to poverty eradication, sustainable economic growth and deepening economic integration.

To date, South Africa has managed to share transboundary water resources equitably with neighbouring states under the SADC Protocol on Shared Watercourses. The challenge will be to maintain this equitable allocation in the future as pressures on water resources increase. There is also a challenge in extending the joint management of shared water to groundwater, and to enhance joint disaster management programmes as climate change leads to increasingly severe flood and drought events.

4 Beneficial use in the public interest

The White Paper on a National Water Policy for South Africa requires that South Africa's scarce water resources are used beneficially and in the public interest. The concept of Water for Sustainable Growth and Development gives form to this idea. While water alone is not sufficient to drive economic growth – other elements such as access to markets, transport etc are needed - non-availability of water and deteriorating water quality can act as a constraint on economic growth. This section will look at the role of water in economic and social development as well as its environmental value. The section also considers the issue of risk in relation to water and the economy, social issues and the environment.

As the demands on water systems increase and they become more stressed (together with the social and economic systems they support), the behaviour and responses of the systems become more uncertain and unpredictable. They become less resilient to change, and more vulnerable to downward spirals as political, social and economic decisions contribute to unexpected consequences and negative feedback.

Business and households alike are beginning to feel the risks associated with security, availability and quality of water. This presents an opportunity to engage both inside and outside the water sector with the issue of water management, to raise water on the political agenda, and to build the linkages between water and economic and social development. Increasingly, other government departments, the commercial sector, households and environmental interests are recognizing that water is integral to sustainable development, not just as an input or constraint. As a result, now is an opportune moment to shift gear in water management.

Risk in the water sector arises from:

- inadequate water availability and/or quality (or excessive flooding) to business, people and aquatic ecosystems;
- the consequences of inadequate water, including increased pricing, instability, foregone opportunities, entrenched poverty or ecological degradation; and
- the consequences of expedient or disingenuous management, infrastructural, economic, regulatory or institutional responses to inadequate water supplies.

These risks are discussed under the various sections below.

4.1 *The nature of the SA economy*

South Africa is the largest economy in the SADC. Economic growth has been positive and increasing since 1994 - annual real GDP growth increased from 3.2% in 1994 to a peak of 5% in 2006 before declining slighting to 4.7% in 2007. Projected growth for 2008 is 4.2%.

The economy is dominated by the manufacturing, retail and services sectors which contribute nearly 50% of GDP. General government services contribute a further 12.7%. Mining contributes 5.8% and agriculture, forestry and fishing only 2.3% (StatsSA). Figure 5 below shows the contribution to GDP by sector in 2007.

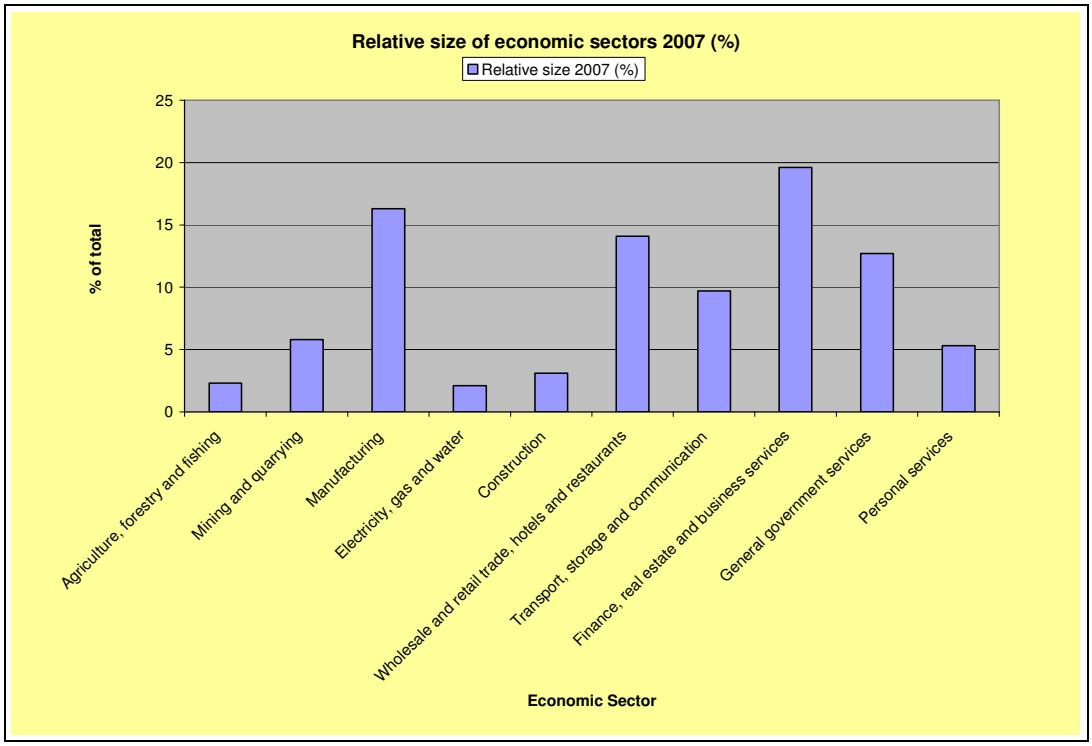


Figure 5: Relative size of economic sectors 2007

The sectors that contributed most strongly to growth in 2007 were, once again, the manufacturing, wholesale and retail trade, hotels and restaurants, and finance, real estate and business sectors, as shown in figure 6 below. The construction sector's contribution has risen strongly, and the transport, storage and communication sector also contributed significantly to growth.

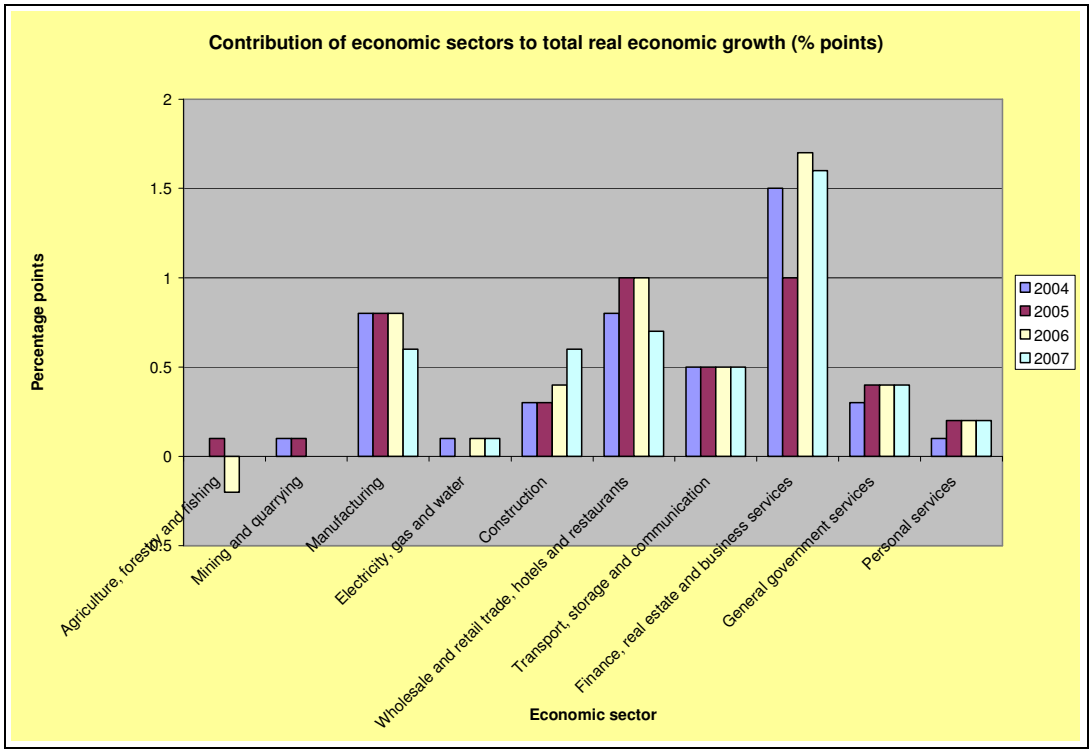


Figure 6: Contribution of economic sectors to total real economic growth

From figure 6, it is clear that some of the major economic growth areas are located within urban areas. The rural sectors of agriculture and mining have shown little growth in recent years. This picture is confirmed by the 26 areas of national economic significance identified in the National Spatial Development Perspective (see map below). These 26 areas produce 77% of the Gross Value Added (GVA) and are where 53% of the poor people in the country live. These are considered to be the key national growth points.

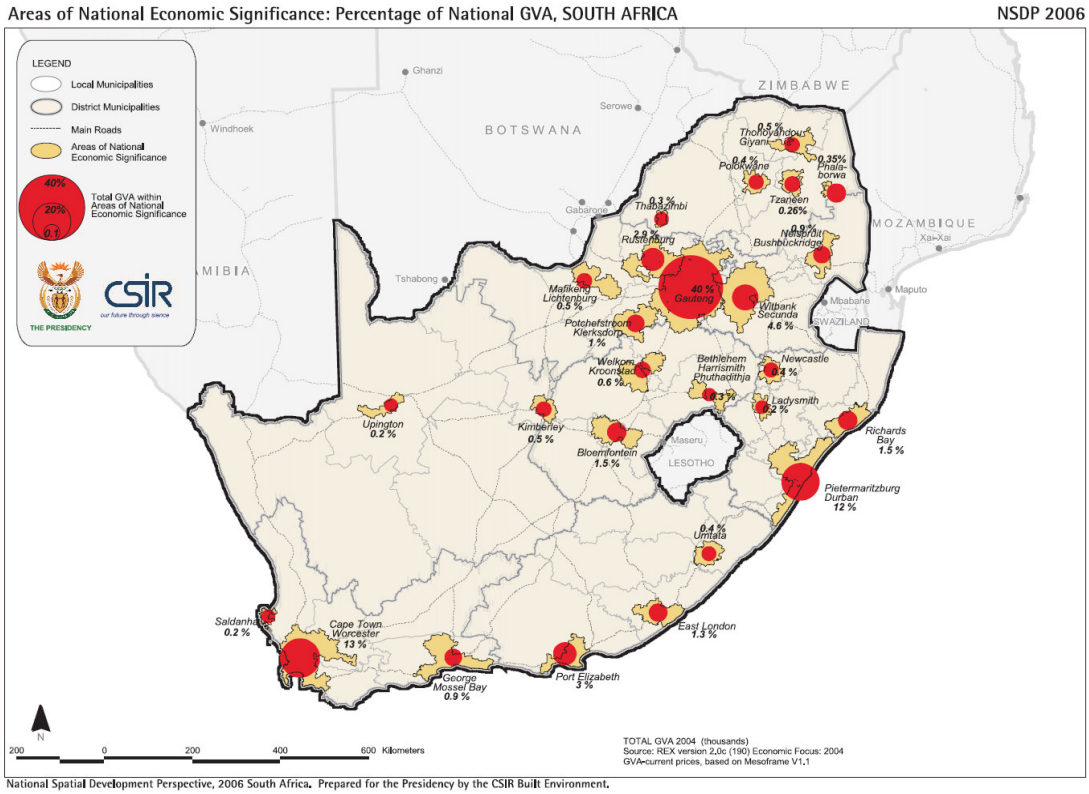


Figure 7: Areas of National Economic Significance

This highlights a particular tension of the South African economic landscape: the major growth points are in and around urban areas, while the rural economy is showing little growth and contributing relatively little to GDP. These trends are fuelling continuing circular migration dynamics between rural and urban areas. The areas of highest poverty and greatest underdevelopment remain the rural ex-homeland areas.

In 2004, South Africa was number 55 in the world (i.e. out of 171 countries) based on the GDP index which is a measure of economic growth. However, in the same year South Africa ranked 121 on the Human Development Index which is a broader measure of welfare showing that the benefits of economic growth are not reaching poorer households (WB, 2006). Therefore, in addition to dealing with absolute poverty, the country also has to deal with high and widening inequality. In 2002, SA had the second highest inequality coefficient in the world after Brazil, despite huge investments in infrastructure and social programs.

Figures from the 2007 Labour Force Survey indicate that the formal unemployment rate decreased from 25.5% in September 2006 to 23% in September 2007, but equally, in the same year, the number of discouraged work-seekers increased suggesting that people that had been previously looking for work gave up hope of finding employment.

Thus, while economic growth is largely urban focused, there is a need for a rural development to create livelihoods, jobs and food security and to reduce poverty in the

rural areas. This tension is one that must be managed in the allocation of scarce water resources to support growth and development.

Equally, the concentration of economic growth in the urban areas highlights the need for the maintenance of good quality and reliable services in these areas, and the extension of water services to serve manufacturing, services, business etc. Over the past 14 years, the focus of municipalities has been very much on providing basic services to the poor. It is clear that, in order to support economic growth, equal focus must be placed on maintaining the existing higher level services and providing new higher level services to support the core economic sectors that drive the economy.

4.2 *Water and the economy*

South Africa has a fairly complex economy with well developed inter- and intra-sectoral linkages as well as international linkages through trade. In addition the economy is also broad-based and well diversified. These factors together with well developed irrigation infrastructure have cushioned South Africa from weather shocks such as the droughts of 1982, 1992, 2003 and 2005, showing that the country is reaping the benefits of early investment in water infrastructure.

As South Africa strives to achieve the targeted annual economic growth rate of 6%, there is need to understand projected water-demand for the sectors that will drive growth to understand the scale of investment in water infrastructure and management to meet this demand. Failure to meet water demand would have devastating impacts on economic and social development.

Although water is far from being the only driver of economic growth, it is crucial to understand the link between water use and economic growth measured, in this case, by value added and employment. There is a large degree of variability in these relationships but, in general:

- Industry generates about 100 times the value added per unit of water used compared to irrigated agriculture.
- Industry generates about 10 times the employment per unit of water used relative to irrigated agriculture.

However, this analysis does not take into account spillover benefits and multiplier effects, the contribution of agriculture to industrial activities, and the strategic role of agriculture in poverty alleviation and environmental protection. This is discussed briefly in the following section.

The investment required to meet the predicted demand for water discussed above is high, and requires investment in bulk raw water infrastructure, regional bulk infrastructure, treatment and reticulation and waste water infrastructure. It also requires significant investment in groundwater infrastructure, management and research. It is difficult at this point to quantity the required investment accurately, and more work needs to be done to understand the investment requirements and the possible source of funding.

Business-Economic Risks
Business includes individuals and entities involved in economic production, ranging from agriculture and forestry, through tourism and recreation, to manufacturing and mining, and from large multi-nationals to small and micro enterprises. Water is indispensable for business, even though it typically represents a small input cost.

While most businesses seldom receives no water, inadequate water contributes to a loss in competitive advantage through higher costs (supply, treatment, electricity, insurance or credit expenses), which undermines investor confidence and business profits. Furthermore, regulatory and reputational risks increase for companies that don't comply with water legislation, as a result, for example, of the time taken to issues water use licenses. Internationally and in South Africa, businesses are becoming aware of and engaging the risk faced by water security. These threats provide an important opportunity to engage business around water in the national as well as the corporate interest, and may become an important driver for technological innovation around water and production.

4.3 *Social value of water investment*

The social and economic values of water are deeply interlinked. Safe, reliable and adequate access to water and sanitation is essential in achieving the Millenium Development Goals particularly on HIV/Aids, hunger and poverty. While attainment of the MDGs is a social objective in and of itself, ensuring better health and nutrition will, in turn, lead to greater productivity with associated economic benefits. Greater economic benefits, if appropriately distributed, will, in turn, lead to greater social well-being.

The social value of water has often taken second place to economic considerations because the former cannot be quantified as readily as the latter. As such, the benefits that come from the societal values of water, such as its impacts on health, dignity, food security, basic livelihoods and cultural and religious traditions are not always given their fair weight by decision-makers. Greater attention needs to be paid to the social value of water and allocation must be carefully assessed against a matrix that includes social, economic and ecological value. For example, as urban demand continues to surge, careful assessment is needed of the socio-economic trade-offs in allocating water away from agriculture; net contribution to GDP needs to be weighed against the social multipliers of sustainable rural livelihoods.

A key thrust of Strategy on Water for Sustainable Growth and Development is to ensure that water contributes to social transformation which requires a strong emphasis on redistribution mechanisms to uplift historically marginalized groups and individuals and currently vulnerable members of the population, and a clear understanding of the social value of water. Untapped groundwater potential can be a key contributor to social transformation through access to water.

Social-Poverty Risks
'Water scarcity, from a human perspective, is the extent to which human needs for water for domestic and productive purposes remain unfulfilled, both in terms of water

quantity and quality. In this sense, only poor people face water scarcity, usually even in circumstances where the natural endowments of water resources are abundant." (Schreiner 2002)

In a society as highly unequal as that of South Africa, insecurity of water supply is predominantly felt by the poor. Inadequate access to water is both the cause and the result of poverty. The poor are more vulnerable to water scarcity due to their limited resources to adapt at a household or community level; they use a disproportionate amount of income on water and electricity. Where water is scarce, the poor typically pay more and receive inferior quality water. This has profound impacts on health and local production and therefore, water scarcity increases the cost of water supply and the difficulty of achieving MDGs. On the other hand, where a basic supply is sustainably ensured through free basic water, the impacts on poverty are significant.

Unless carefully managed, building dams, abstraction of water and discharge of waste can have significant negative impacts on local rural communities. Where water systems deteriorate or even fail, poor people resort to increasingly inadequate local water resources or expensive vendor arrangements, while more affluent households make alternative arrangements and potentially exit the system. This compounds the impacts on the poor and can reduce the interest of affluent customers in funding improved supply or waste systems.

South Africa's legacy of racially determined entitlement to water for productive purposes severely exacerbates poverty in rural communities. The water allocation reform process, linked to land reform, provides the opportunity to address this social and ultimately political risk. Accelerated reallocation and ongoing productive use of water by historically disadvantaged groups is critical to government's rural development strategy.

4.4 *Economic and social value of water resource quality*

Water is well recognised as an economic good, and is often considered as a social good whose value can be measured, but the value of aquatic ecosystems is less understood. Aquatic ecosystems offer valuable goods, services and attributes that contribute to human welfare and that have economic value. Resources that can be harvested, such as fish and reeds are considered to be goods, while services are processes offered by water resources such as water purification. The attributes of water resources include beauty, and educational, cultural and recreational aspects.

Aquatic ecosystem goods are critical for the poor, who often depend on them for their livelihoods. For instance, fishing is a key economic activity in poor communities along the coast, craft made from wetland reeds remains an important source of income for women in rural KwaZulu Natal and subsistence farming of indigenous agricultural crops in wetlands remains essential in food security for the rural poor. Changes in availability of these services affect the well being of the poor.

Already there are clear signs of degradation in some of South Africa's rivers, estuaries and wetlands due to competing use and increasing demands. Increased growth is

resulting in changes in local land use and land cover, modification of river flows, introduction of alien vegetation, accelerated agricultural practices, increased discharge of pollutants and unsustainable fishing practices. Unless properly managed, these changes will have a significant negative impact on aquatic ecosystems. Poor water quality will affect the sports and recreational value of water bodies and the tourism and aquaculture industries. These effects will be exacerbated by climate change.

If the environment is not valued in the allocation of water, all water will be allocated to consumptive use. If aquatic ecosystems are over protected, there are opportunity costs to economic use. This means achieving a balance between viewing water as a commodity to promote economic growth, create jobs and eradicate poverty; and recognizing its role in maintaining the functioning and resilience of ecosystems. This balance must also serve to maximize societal welfare and address the important issue of inequality i.e. the distribution of benefits from water and aquatic ecosystems. It also needs to balance the needs of present and future generations.

Because of the inertia in both ecological and human systems, the consequences of any change to the aquatic ecosystem made today may not be realised for years. Thus sustaining aquatic ecosystem services requires wise management of the relationships between human activities, aquatic ecosystem change, and well-being over the short, medium and long term. In developing plans to ensure the integrity of aquatic ecosystem services, it is imperative to capitalise on traditional and local knowledge for the protection of the resource. Adaptive management is also critical in the management of dynamic systems such as aquatic ecosystems.

Ecological-Environmental Risks
Freshwater ecosystems in South Africa are adapted to significant natural variability, but also contain some severely threatened species. The nature and rate of change is critical to the ongoing ability of these systems to function effectively. These systems are vulnerable to changes in the flow and quality of water resources, and are threatened by water use and development. The combination of inadequate water and ecological degradation poses significant threats to the environment, including people and economic activities that are directly dependent upon it.

Political Risks
Business, social and ecological risks together pose political risk to the country. As these risks rise, the pressure for expedient and expensive infrastructure or legislative interventions increases. This can have profound economic, social and ecological repercussions. Where water is locally inadequate, local economic and social development is typically curtailed or destabilised. While this is unlikely to be widespread in South Africa, there are areas in which water is a constraint on development. Effective, proactive and integrated planning is critical to ensure the management of water systems to mitigate risk.

Where water security is not adequately managed, water supply and allocation may become an electoral issue at a local and ultimately even at a national level. At the international level, inter-country political dispute over shared water resources can lead to political tensions. These can frustrate regional (rather than national) integration

and development initiatives. At the local level, water often creates tensions that undermines social stability and frustrates development.

5 Principles for Water for Sustainable Growth and Development

This section sets out the principles that underpin water for sustainable growth and development which should underpin all work done in the water sector, not just the programmes set out in this strategy.

The 'Fundamental Principles and Objectives for a New Water Law for South Africa', drafted in 1996 and reflected in the 1997 White Paper and the 1998 National Water Act, are still applicable in the context of ensuring water for sustainable growth and development. The following principles have particular relevance:

Principle 7
The objective of managing the quantity, quality and reliability of the Nation's water resources is to achieve optimum, long term, environmentally sustainable social and economic benefit for society from their use.

Principle 8
The water required to ensure that all people have access to sufficient water shall be reserved.

Principle 13
As custodian of the nation's water resources, the National Government shall ensure that the development, apportionment, management and use of those resources is carried out using the criteria of public interest, sustainability, equity and efficiency of use in a manner which reflects its public trust obligations and the value of water to society, while ensuring that basic domestic needs, the requirements of the environment and international obligations are met.

Principle 14
Water resources shall be developed, apportioned and managed in such a manner as to enable all user sectors to gain equitable access to the desired quantity, quality and reliability of water. Conservation and other measures to manage demand shall be actively promoted as a preferred option to achieve these objectives.

Principle 16
Water quality management options shall include the use of economic incentives and penalties to reduce pollution, and the possibility of irretrievable environmental degradation as a result of pollution shall be prevented.

Principle 22
The institutional framework for water management shall as far as possible be simple, pragmatic and understandable. It shall be self-driven and minimise the necessity for State intervention. Administrative decisions shall be subject to appeal.

Principle 23
Responsibility for the development, apportionment and management of available water resources shall, where possible and appropriate, be delegated to a catchment or regional level in such a manner as to enable interested parties to participate.

Principle 24

Beneficiaries of the water management system shall contribute to the cost of its establishment and maintenance on an equitable basis.

Over and above these principles, the following principles should be applied in addressing the issue of using water for sustainable growth and development:

1. All economic and development planning must include an assessment of water availability and effluent management.
2. Decisions regarding the use of water must balance the economic, social and environmental dimensions of water.
3. Decisions regarding the use of water must focus particularly on poverty eradication and social justice.
4. Water investment should give equal emphasis to the maintenance and refurbishment of the current asset base, and the development of new infrastructure.
5. Priority should be given to optimizing efficient use and productivity to obtain more value per unit of water
6. Sound management and use of local resources, including groundwater, should be prioritized before accessing more distant resources.
7. Institutional reform should tailor the institutional arrangements of the water sector to fit more closely with the capacity to deliver
8. Sustainable service provision and water management rests on a strong partnership between citizens and government, with mutual accountability.

6 Opportunities to optimise Water for Sustainable Growth and Development

This section examines the opportunities for improving the management of water in South Africa in order to ensure that water is used most effectively to support growth and development. It considers the constraints and challenges that have been identified by the sector and addresses them as opportunities to manage water better.

6.1.1 *Adapting to and managing for Global Climate Change*

Climate change affects everyone, in both developed and developing countries, but the ability of the society to manage the impacts will determine their severity. Managing and mitigating the effects remain complex due to the unpredictable nature of the change, particularly at the local level, and because historical hydrological data becomes increasingly irrelevant. Despite these challenges South Africa needs to respond as climate change adds an additional dimension to our already stressed and scarce resource.

New approaches and attitudes are imperative if we are to effectively prepare, mitigate and adapt to the effects of climate variability. Priority must be given to developing robust strategies to ensure that demand matches supply, even where water availability is reduced. Water engineers will need to think outside the design assumptions of existing water infrastructure to accommodate higher demands in hotter, drier seasons when supply is at a minimum, floods that exceed the capacity of existing protection structures, high rainfall that exceeds existing sewer capacities and less dilution of wastewater discharge into rivers with reduced flows. Institutions need to go beyond managing water on a day to day basis to identifying water use trends, areas vulnerable to climate change and opportunities to respond to the emerging challenges. The issue of managing schemes more effectively as integrated schemes or as regional schemes must be investigated. The potential for groundwater use and artificial recharge is a crucial strategy for managing climate change impacts.

Addressing the effects of floods and droughts remains a shared responsibility between government departments such as DEAT, DoA, DoHealth, DPW, DoT, DoE, DPLG and DWAF. Therefore, a mitigation and adaptive management approach would be an integrated approach that addresses the priorities of all sectors.

Substantial investments will be required in water infrastructure and other water management strategies to adapt to climate change and bolster resilience. This may require significant shifts in allocation and increases in water pricing, with a range of knock-on impacts for production across the economy.

1.1.1 Adaptation and Management of Change and Complexity

As described, risk tends to increase as water systems become more stressed. These risks may be amplified by expedient infrastructure or institutional interventions and are exacerbated by rapid change in climate, land use and/or water use. Typically groups with resources and alternatives are able to adapt, while marginalised communities (typically the poor) and the environment bear the greatest risk.

However, adaptive capacity can be created, typically through diversity, decentralization and learning in the institutional arrangements and responses

6.1.2 *Innovation and Appropriate Technology*

To meet the challenges in the water sector, technical innovation and appropriate technology must be encouraged, ranging from the large-scale water provision requirements for economic growth (such as desalination), through micro-level production processes (recycling and re-use), to the local decentralized water supply needs for rural development (rainwater harvesting). The increasingly important relationship between energy, water and waste needs to be engaged by government, business and civil society.

This requires more sophisticated responses by the sector with multi-disciplinary expertise and the courage to adopt new approaches. However, pragmatism, simplicity and efficacy must be paramount in the adoption of these approaches and technologies, to prevent 'the best being the worst enemy of the good'.

6.1.3 *Monitoring, Targets and Adaptive Management*

Being able to respond in an adaptive and innovative manner will require improved information. Effective monitoring of the state of the country's water resources, water use, water infrastructure and institutional performance, therefore becomes increasingly important as we move forward to implementing Water for Sustainable Growth and development. This monitoring and associated evaluation must be against clear and unambiguous targets for the water sector, which truly describe the achievements and failures of the water sector, not as a means of apportioning blame, but to improve future service delivery against social and economic objectives. This is the basis of self-reflection and learning required to develop the adaptive capacity within the sector that is required to manage complexity, uncertainty and unpredictable outcomes. This requires appropriate institutional arrangements to share information and act on the outcome of monitoring and evaluation by adjusting strategies and operation, within a coherent strategic intent.

6.2 *Investing in people*

There is a need to invest in people for effective water management, including civil society, corporates (from the very largest to the smallest enterprise), state officials, and politicians. The last two categories (state officials and politicians) are servants of the first two, and the investment in people should be done in a manner that builds the capacity of these groups to serve the needs and aspirations of the first. Equally, civil society and the business community must be able to express their water needs and to contribute to management decisions regarding water.

The challenge is in implementing the very progressive policies for public participation that have already been developed in a manner that gives meaning to people's lives, including enabling citizens to engage more effectively with the politicians meant to represent them and give greater feedback to the public on water management issues.

Investing in people for IWRM has to take place at several levels. There is a need to raise awareness around water issues, and especially water scarcity and the need to conserve water.

In Catchment Management Agencies and Water User Associations resource poor farmers sit at the same table as organized business, mining and other corporates. However, broadening real decision making about how resources are allocated requires far more than bringing representatives of the poor to the table. It requires training and support to level the playing fields so that these representatives can negotiate as equals.

6.2.1 *Rebuilding partnerships between providers and citizens*

In recent years, South Africa has experienced a high number of service delivery protests, driven in part by frustration over service delivery and poor relationships between citizens and government. Equally, the delivery of improved services in areas that have historically received substandard quality of services has, in many localities, taken a back burner to efforts to eradicate backlogs in water and sanitation. The opportunities for citizens to express dissatisfaction at the local level, and for measuring the degree to which the state responds, is very uneven across the country, given widespread failures in the ward committee system**.** This has lead to widespread disengagement of citizens from public involvement.

This creates a significant constraint for citizens to learn about their rights and responsibilities. The latter is critical in educating the public about how to resolve matters such as incorrect billing, estimates that overcharge, faulty meters, taps leaking, and so on. Each of these service delivery issues can lead households into a debt trap that can lead to a significant deterioration in their quality of life. Equally important, if citizens disengage from public life, it undermines valuable training opportunities which can support household water conservation and management. Arguably, sustainability for South Africa's water services sector lies in going back to basics, and re-emphasizing the reciprocity of rights and responsibilities. Perhaps South Africa needs to re-combine the institutional sophistication of the 2003 Strategic Framework for Water Services, and its emphasis on service delivery by municipalities, with the developmental vision of the 1994 White Paper, with its emphasis on mobilizing ordinary people to strengthen water services provision - down to reporting burst pipes, fixing tap washers and paying for services beyond the first free basic amount.

6.2.2 *Skills development*

Much has been said over the past years about the skills shortage in the water sector, particularly in local government and in DWAF. This skills shortage threatens the viability of CMAs, as well as the smaller Water Boards as well. The nature of the skills shortage, particularly in relation to the water services sector is well researched and documented.

A range of on-the-job mentoring and support programmes are in place – Siyenza Manje, ENERGYS and others – which are helping to fill key gaps wherever possible. But stronger emphasis is needed on filling key positions with people who have both

the right skills and the necessary experience to meet the job's requirements. Where a senior position requires ten or more years' experience, there is no substitute for this level of experience. Progress in building capacity through the Sector Training and Education Authority has been disappointing.

The focus for the past decade has been on trying to create a sufficiently large cadre of competent officials to staff the large number of water management and water services institutions in the sector. The success has been limited. An alternative approach is to review the vast number and range of current water institutions and identify how a rationalization of such institutions could result in better deployment of the limited skills available. The need to rationalize the water institutions is dealt with under section 6.5.3..

This is not to suggest that the current programmes for building capacity should be halted, or that much needed programmes to create a new skills base should not be initiated. A cadre of people with a new set of skills is urgently needed for ensuring effective water management, particularly regulatory, asset management, financial, resource economic and water conservation skills. These are all areas of high priority in the management of water for growth and development.

Two particular challenges come to mind as areas where skills need to be built urgently. The first relates to the financial skills in the water sector that are needed to understand the long term financial costs and therefore the potential sustainability of water schemes. The second relates to the urgent need to build groundwater capacity in DWAF and the CMAs. Groundwater is an extremely important resource, particularly where surface water resources are not readily available. In the face of climate change, groundwater, which is not susceptible to the high levels of evaporation of surface water, becomes more important. However, the groundwater capacity in DWAF has been severely eroded, resulting in an inability to manage this critical resource optimally in the interests of growth and development.

6.3 *Leveraging infrastructure*

Significantly greater investment in water sector infrastructure is needed to safeguard water availability and assurance. Large scale new asset creation is underway, but there is a substantial backlog on spending on maintenance, rehabilitation and renewal, and urgent attention must be given to effective asset management of new infrastructure to ensure that it, too, does not decay through under-funding or neglect. Storage and supply infrastructure needs to be augmented, not only to ensure water availability but to manage water quality too, through provision of clean raw water for blending to dilute the effects of pollution and salting. And there are enormous opportunities to extend the benefits of water provision to under-served areas, to support food security and income generation through water for production.

6.3.1 *Infrastructure development for water security*

Comprehensive assessment of how best to reconcile demand for water with supply, at regional and local level, is underway. Detailed reconciliation studies build on the strong framework for infrastructure development provided in the 2004 National Water

Resource Strategy. This document is not the place for a detailed discussion of infrastructure needs and developments, scheme by scheme, as this will be captured in the revised NWRS.

DWAF is confident that its water resource planning and infrastructure development is sufficiently robust to support the objectives of the National Spatial Development Perspective (NSDP), and particularly water supply to the 26 identified nodal growth points. But there is growing concern about the adequacy of many regional bulk schemes to meet growing municipal water demand. The missing link in the national planning and infrastructure delivery chain is master-planning at municipal level; very few municipalities have up-to-date master-plans detailing water services infrastructure capacity and augmentation needs, both for internal and external bulk infrastructure, and WSDPs seldom provide the requisite technical detail to inform robust regional planning. This gap compromises the accuracy of DWAF's water services Reference Frameworks, which are used to inform water resource macro-planning and infrastructure development. At local level, there is a high risk of the available infrastructure falling short of requirements when inadequate planning combines with poor asset management.

Treasury has allocated R1.8-billion over the next three years to augment regional bulk infrastructure, but the short-list of projects warranting urgent funding is R4.5 billion, and the likely overall figure is substantially more. But without local master-plans, it is difficult to quantify the parameters of funding required, or to prioritise allocations. Infrastructure macro-planning at local level must be strengthened as a matter of urgency, as must the links between municipal water services planning and national resource planning.

6.3.2 *Asset management: optimizing available resources*

Strengthen life-cycle management of infrastructure assets
Sound asset management is not being given the priority it warrants, across the sector. Without adequate maintenance, the asset will fail long before it reaches the end of its design life. Preventative maintenance is essential to keep the system working, and to keep reactive repair to a minimum. The life of an asset may be extended, through refurbishment or rehabilitation, before it reaches the end of its design life. But any asset has a finite life, and will need to renewed or replaced.

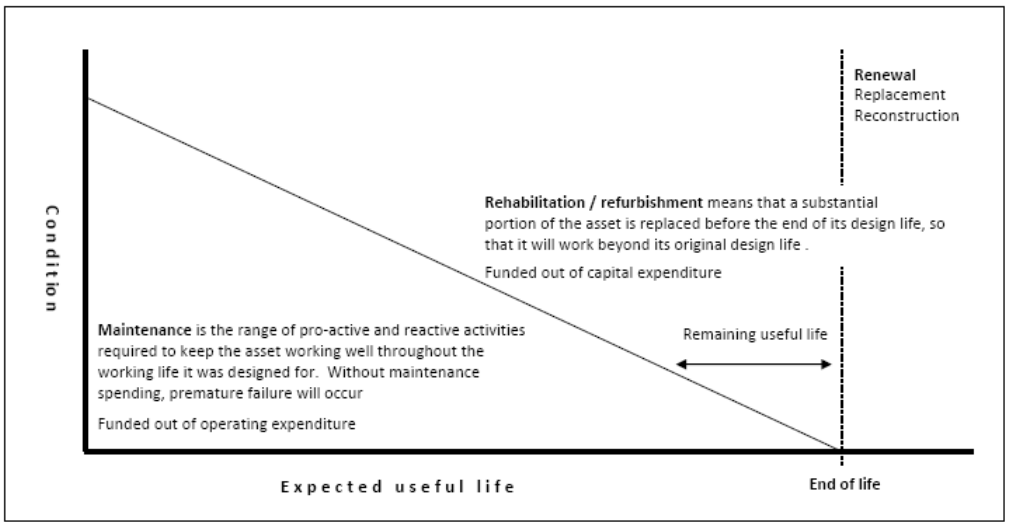


Figure 8: The difference between maintenance, rehabilitation and renewal

There is an urgent need to adopt a life-cycle approach to asset management, so that infrastructure planning looks beyond capital costs and construction to whole-life requirements. Capital costs are generally less than half the full life-cycle costs, and can be as little as 20% for some infrastructure. Moreover, assets have different costs at different phases of their life cycle, with older assets typically requiring higher maintenance expenditure; this is why it is important that asset management is supported by a comprehensive asset management plan, so that the financial and other requirements for reliable performance are understood and provided for.

Three sources of information indicate that there are severe problems associated with the condition of water sector infrastructure assets. Firstly, the Minister reported to Parliament in March 2007 that 160 out of 294 dams owned and operated by the Department (54%) require maintenance to meet current safety standards, although none are structurally unsafe; repairs are underway on 42 of these dams. In addition, 17 canal schemes require major rehabilitation work. Secondly, the level of expenditure on maintenance of water services assets has consistently fallen below the Construction Industry Development Board (cidb) guideline estimate of 4% of total replacement value per year. This would imply an expenditure of R7.2 billion annually, yet municipalities barely spend this amount on all their maintenance activities, including other sectors. Finally, asset performance appears to be declining, with a growth in unplanned network outages reported.

The value of investment in water sector infrastructure is immense. In 2001, the replacement cost of water resource management infrastructure was estimated at R38-m. Subsequent developments and inflation would raise that figure above R50-billion today. Water services is particularly capital intensive, and sound management of assets is a prerequisite for good management of water services, both from a service delivery and sustainability perspective. In 2006, the CSIR estimated that the replacement cost of water services infrastructure that is the responsibility of Water Services Authorities was at least R120-billion, and that of the water boards was a further R60-billion. Some water management and water services institutions have

excellent asset management systems in place, but there is growing evidence of deficiencies across both water services and water resource management.

South Africa simply cannot afford the financial, economic, social or environmental cost of any further deterioration of this asset base.

Augment supply through smart asset management: reduce leaks and losses

At least 22% of South Africa's stored water fails to reach its destination as a result of leaks and losses in conveyance and reticulation infrastructure. Losses are highest in agriculture, with urban losses mounting steadily. Loss reduction strategies have the potential to buy SA decades of greater water security, reduce conflict over competition for scarce resources, and boost municipal income nationally by literally billions of rand through reducing non-revenue water.

Strengthen municipal viability through improved asset management

Investment in municipal water services infrastructure is rising by about 26% per year, but municipal revenue is rising less rapidly than the growing cost of providing services as coverage is extended. In many areas, it is evident that the gap between expenditure and income is being funded through under-spending on maintenance and inadequate provision for rehabilitation and renewal, leading in practice to asset stripping. Deterioration in the quality of service delivery is inevitable, which is likely to affect payment levels and compound the downward spiral.

MIG funding is intended to fund infrastructure for basic services for the poor. However, many municipalities are struggling to raise funding for new infrastructure for non-poor users, whether they are middle class households or industrial or commercial users. A 2007 DPLG report notes that municipal borrowing is declining as a source of capital funding, and that this is likely to decline further as municipal debt rises. The report notes that capital subsidies have displaced private sector borrowing, and, instead of the available funding pool for infrastructure provision increasing, overall capital investment in services infrastructure has in fact decreased in real terms over the last decade. If true, this is a deeply unfortunate consequence of well-intentioned grant funding.

In many areas, it would appear that the MIG programme is funding the construction of service delivery infrastructure which is too costly to operate without significant subsidies, beyond the Equitable Share. Careful assessment of the long-term trajectory of this type of investment is needed to ensure that MIG funds assets, not liabilities.

An urgent review of the state of municipal investment in water services infrastructure is needed to turn this situation around. As argued earlier, neglect of existing infrastructure networks is eroding municipalities' asset base and compromising their revenue generation and broader economic development prospects. A focus on providing basic services is essential, but the needs of the poor are best served through an integrated approach which addresses the water servicing requirements of the broader economy, as these are the vehicles for generating cross-subsidies and jobs.

Address municipal maintenance, rehabilitation and renewal backlogs

The rate of reduction of backlogs in access to water services infrastructure is being tracked closely. But this is only one component of water infrastructure backlogs; there are backlogs in maintenance, refurbishment and replacement across the water sector, and growing concern about the proportion of infrastructure that is old or dysfunctional, and needing urgent rehabilitation or replacement.

Municipalities are allowed to fund renewals out of MIG funds, but MIG funding does not make adequate provision for renewals on the scale required. Treasury is exploring a separate Renewals Fund to extend the working life of existing assets; but without asset registers for water services and water management institutions, it is difficult to assess requirements effectively or allocate funds. Very few WSAs - 25% of Metros, 9% of Districts and 7% of Local Municipalities who responded to a mid-2007 survey - currently have an approved asset register in place to enable them to manage and account for their assets. Just two municipalities nationally have completed an asset management plan, although asset management planning is underway in a further 23. The Municipal Finance Management Act requires a municipality's accounting officer to take 'all reasonable steps' to compile an asset register; are stronger measures and sanctions required, where this requirement is disregarded?

Strengthen provision for long-term asset management

Many providers are not making adequate financial provision for the long-term operation and management of their infrastructure. Annual budgets for this purpose are often inadequate because of their limited financial capacity (together with increasing responsibility) or inappropriate allocation of funds. Ironically, this financial distress applies primarily to the operating budget, because significant grant funding is available for capital expenditure. Thus as capital expenditure continues on the basis of grant funding, the gap between capital expenditure and the operating budget is likely to widen.

The operational debt of some municipalities is so severe that even if no further infrastructure is developed, it will be extremely difficult to catch up with existing maintenance backlogs and restore sustainable operations, without innovative external support. This calls for rigorous assessment of the root causes of the current problem. A clear distinction must be drawn between historical maintenance and rehabilitation backlogs, for which municipalities have a legitimate claim to funding support, and current bad practice. Providing further funding to mitigate the consequences of poor management of new assets will simple create perverse incentives to continue to neglect asset and revenue management.

Going forward, there is surely scope to explore opportunities to leverage MIG, a conditional grant, to require municipalities to honour the maintenance commitments they make when applying for grant funding, and to turn around current poor performance in maintenance spending.

6.3.3 *Managing water quality through infrastructure*

Increasingly, as raw water quality deteriorates, water resources infrastructure is required to meet not just quantity but also quality drivers. Increasing volumes of good quality water are required for blending to dilute the impacts of salting and high nutrient loads. This has implications for the availability of water in the system, and adds to infrastructure requirements for storage and transmission.

Just 2% of the water in the Vaal Dam, for example, is from the Highveld mining and industrial area, but it requires extensive blending with cleaner water from other sources to safeguard the requisite water quality in the dam. Alternatives include desalination or reverse osmosis, but the cost is prohibitive except at small point-of-use installations for specific industries. These challenges underline the urgency of implementing the waste discharge charge mechanism, to incentivize better waste discharge management and water resource protection and support pollution abatement measures.

6.3.4 *Meeting people's needs*

There are a range of opportunities to make more water available in ways that meet people's needs for water, beyond domestic consumption or large-scale irrigation. These include a range of small-scale productive uses and micro-enterprises like backyard gardening, keeping livestock, making bricks or running a hair salon. Not all of these require potable water, and where alternative sources can be developed, they should be explored.

Additional storage is needed particularly in rural areas, since food production is a main user of water and the poorest rely on rain-fed agriculture and are very vulnerable to dry spells. A little water can make a substantial difference for the poorest. Individual or communal, low-cost storages linked to multiple use systems is where new effort is needed.

There are strong arguments to expand micro-scale individual homestead rain water harvesting systems. This is not 'cheap storage for the poor'; cost per volume storage is high, but the impact is high: an Internal Rate of Return of 15% has been calculated on the recorded value of food production from homestead RWH tanks. The greatest value households place on their RWH storage is the autonomy it gives them in decision-making over the use of their water. These strategies should not limit the rural poor to subsistence, nor should the food needs of the urban population be ignored. Local storage is not an alternative to large-scale storage, especially for meeting wider needs.

Making more water available to poor households is not a remedy for poverty, but international experience is emphatic that access to water for productive uses enables a more diverse range of livelihoods activities, and hence reduced exposure to risk. Developing and investing in small, household-scale storages in under-developed areas could reduce the need for rural -urban migration and improve socio-economic development in line with the millennium development goals.

Investment in new storage needs to be in step with investment in enabling factors and capacity to utilise it: not only the distribution network and institutional systems and arrangements to enable continued and reliable supply, but also roads, markets, access to micro-credit, business support and extension services, and so on.

Implement multiple use systems

South Africa has embraced the approach of multi-use systems to address the multiple water needs of communities e.g. domestic and productive use. The challenge remains in implementing this approach, and, in particular, enabling local government to plan for and implement this approach. Implementation, however, has particular challenges in urban and peri-urban areas where the use of potable water for food gardens is often inappropriate and expensive. Creative approaches must be developed to ensure conjunctive use of water sources to enable productive use without using expensive and treated water. The use of groundwater, where feasible, is particularly useful in this regard.

6.3.5 *Review current approaches to consolidate the gains made in improving sanitation*

Nearly three million households have received new toilets since 1994. Most spending on sanitation is in urban formal areas, and on flush toilets; backlogs in rural areas remain extremely high. The focus has been on infrastructure, rather than broader sanitation improvement, and many of the new toilets are no longer usable. A growing number of new flush toilets malfunction, particularly those built swiftly to meet bucket eradication targets. The number of sewage spills from overloaded systems is rising steadily. Some houses have two new VIP toilets, built by parallel programmes. Many VIPs are built badly, some are not being used at all, and unusable full pits means people are reverting to unimproved toilets or open defecation, with little net gain in health or hygiene behaviour.

The national sanitation programme has now been running for ten years, and a significant number of VIP toilets are now full and unusable, as they have a design life of seven to ten years – although many fill far sooner. Clarity is required on where responsibility lies for pit-maintenance and funding of pit-maintenance or replacement. This further raises the question as to whether VIP toilets, which need desludging or replacement when the pit is full, is an appropriate technology where there is an implicit expectation that municipalities should take responsibility for servicing them. If the pit cannot be desludged, and the top-structure cannot be moved to another pit, are households entitled to a second – or further – subsidized toilet? It would appear that the Basic Household Sanitation policy needs to be updated and that the meaning of Free Basic Sanitation for non-flush systems needs to be clarified.

As a matter of urgency the sector needs clear policy to guide full life-cycle management of VIP toilets. Pit sludge constitutes hazardous waste, so it is unwise to require households to desludge their toilets and dispose of pit waste themselves; at the very least, guidelines are needed for managing handling and disposal of pit sludge, to ensure it does not endanger people's health, contaminate water sources or constitute an environmental hazard.

Remediation options are needed urgently to avoid a second generation of sanitation backlogs that is far more complex than the first. VIP toilets need movable top-structures, bigger pits, better solid waste management, more effective information for users, and clearly defined maintenance roles and responsibilities. Most municipalities do not know how to deal with full pits, and users do not see this as their responsibility. The pressure to deliver new toilets swiftly is constraining scope for innovation and correction.

In relation to water borne systems, several investigations confirm that many wastewater plants are poorly maintained and under-staffed, raising the question as to whether the country has the skills needed to achieve safe and effective wastewater treatment on the scale required. One consequence is that the majority of works are discharging inadequately treated effluent - raw sewage, in some places - which puts the health of downstream users at risk, and feeds algal blooms which choke the environment and, under the right conditions, breed toxins which endanger human health.

The current state of sanitation provision warrants frank discussion. In many areas, what is being provided is not sustainable, and it is the health and dignity of the poorest which is compromised when systems fail. We need options that are more manageable. In many urban areas, less complex, more reliable, less skills-intensive ways of treating wastewater are needed. Where flush systems are not feasible, source separation technologies could be revisited, with a collection service for less hazardous dried waste, and properly managed composting.

6.3.6 *New infrastructure opportunities*

South Africa must continue to explore new storage and transfer schemes to augment supply to deal with variability and buffer droughts, and to meet increasing demand. However, there is a need for a far greater range of augmentation options, appropriate to different needs and circumstances: large and small dams; underground storage, (through managed aquifer recharge where feasible); rainwater harvesting, whether in-field, in reservoirs or in household tanks.

However, new storage is only one option among many to increase available water. There is enormous scope to make more effective use of our existing water supplies: through greater use of groundwater; through more efficient production processes, particularly in agriculture; through repairing and replacing infrastructure to minimize leaks and losses in existing schemes and networks; through recycling and re-using water, particularly in coastal towns and cities where wastewater would otherwise be discharged out to sea; through desalination, particularly as solar technologies evolve to reduce the cost of high energy requirements; through harnessing technologies in innovative ways – using reverse osmosis or bio-chemical processing to treat mine decant and make it available for domestic or other use; through greater use of groundwater; and through imposing significant penalties for water theft.

6.3.7 *Boost water security with groundwater and underground storage*

There is considerable potential to boost groundwater yields and increase borehole reliability across most parts of South Africa through improved monitoring and management.

Over 300 towns, and a far higher number of villages and rural settlements, depend solely on groundwater, but there is seldom any monitoring and management of the resource to ensure abstraction does not exceed recharge rates. Most users abstract from their boreholes with little information on the appropriate pumping rate for that site, with the result that many boreholes, and in extreme cases, aquifers, are being over-pumped. In a growing number of settlements, rising demand is leading to borehole failures and severe water shortages. In several North West towns, for example, water is now available only for several hours a day, and sometimes not at all.

The primary cause of borehole failure is mismanagement, not dewatering of the aquifer. With proper management, far greater volumes of water can be made available. This requires data on the characteristics of the aquifer and its replenishment rate, based on simple monitoring of borehole water levels and abstraction, to inform a sustainable yield management plan. Borehole pumps that are too strong can lead to borehole failure and at times the ingress of poor quality water. In extreme cases it can lead to the dewatering of aquifers. Conversely, continuous steady pumping at a lower rate can deliver far greater volumes. Water failures each summer in Prince Albert in the Karoo, for example, have been reversed through installing smaller pumps.

There is also significant scope for increased underground storage through managed aquifer recharge in which surplus surface water is transferred underground via boreholes or infiltration basins. This is an efficient way to store water because it is not vulnerable to evaporation losses. Not implementing artificial recharge where conditions are favourable is like choosing not to divert water into a dam to keep it as full as possible.

Atlantis, near Cape Town, has practiced artificial recharge for over 20 years, using treated wastewater for recharging a sandy aquifer all year around. Karkams, in Namaqualand, practices opportunistic artificial recharge, as rainfall is irregular in that part of the country. Other towns such as Plettenberg Bay are considering recharging only in winter when surplus water is available from rainfall. Not all aquifers are suitable, as some fill up naturally when water is available, leaving no capacity for further storage through artificial recharge. Artificial recharge costs a fraction of other storage options, and it can be implemented incrementally, saving on huge initial capital outlays. In Namibia, Windhoek opted for artificial recharge rather than abstraction from the Okavango River because it is vastly cheaper and provides the same levels of water security.

All artificial recharge schemes require sound management – not least to ensure that only water of the appropriate quality is transferred underground.

6.4 *Finance and pricing*

There are a number of areas of improvement in terms of finance and pricing that will support water for growth and development.

6.4.1 *Strategic Asset Management, Financing and Pricing*

The importance of strategic asset management of infrastructure has been outlined above. This is critical in an environment where water infrastructure for growth and development is increasingly financed through a mixture of public funds and private capital, supported by the recovery of operating and debt repayment costs from water users. It implies that asset management must consider both the technical requirements for effective and safe operation and the financial requirements for debt acquisition and repayment. Raising debt on existing or future infrastructure requires assurance of a future income stream for repayment, which in turn depends upon adequate maintenance to ensure the supply of water against this income stream.

This is particularly important for water resources infrastructure to be managed by the NWRIA, but equally has implications for bulk and even retail water services infrastructure. The setting of charges and tariffs for recovery of infrastructure development and operating costs must increasingly consider the debt repayment period against the timeframe for the next infrastructure or augmentation project, rather than a simplistic design period. To be effective for water resources management infrastructure, this should be linked to system-based user charges, rather than scheme charges, following the approach currently used in the Vaal system.

6.4.2 *Water pricing, tariffs and user charges*

Water pricing in South Africa includes the Raw Water Pricing Strategy which regulates the charges and levies imposed on water users who abstract water directly from, or discharge waste directly to, the resource; and water and sewerage tariffs levied by Water Boards and Water Services Authorities.

Water pricing in South Africa aims to cover the financial (infrastructure) and the institutional / management costs of water, although significant subsidies to agriculture and emerging users exist. Broadly, the economic cost (opportunity cost) and the environmental (externality) costs of water are not incurred by water users; this conveys a significant subsidy to water users, which is borne by society at large, through the fiscus, and by the environment.

As water is both a social and an economic good, subsidizing water use to achieve certain strategic objectives is appropriate. Nevertheless, moving towards reflecting the true cost of water is necessary in the decades to come, particularly given the water stressed nature of the country and the uncertainties associated with climate change, changing water use and demand, and the institutional / management environment. Retaining the status quo where water is heavily subsidized for certain economic sectors is not feasible or appropriate, and a closer focus on sustainable development that considers the long-term impact of water use activities is required. A distinction can be drawn between water pricing that recovers costs of activities (water charges) and water pricing that seeks to change water use behavior and drives efficiency (water

taxes). A combination of these mechanisms will be required to drive towards increasingly sustainable development and utilization of South Africa's stressed water resources.

In particular, the following pricing strategies should be considered:

1. Water pricing that recovers the full financial and institutional (management) cost of water – such costs are likely to escalate in coming years as the requirement to develop additional sources (augmentation) and to more closely manage resources increases;
2. The polluter pays principle should be implemented, through a mechanism that transfers the cost of pollution to the polluter, including the environmental and opportunity cost of pollution;
3. Raw water pricing that more closely approximates the opportunity cost of water, thereby driving towards increased technical and economic efficiency in water use;
4. Targeted subsidies that support government's social and economic objectives;
5. Municipal tariffs that move beyond full cost recovery (infrastructure and management) to encourage water saving and greater awareness of water scarcity amongst domestic and commercial users, with stratification to ensure affordability is not compromised for the poor ;
6. Charge and pricing strategies that support the re-allocation of water to achieve redress, international obligations and the Reserve, including pricing that supports the clearing of alien invasive plants.

6.4.3 *Financial Support, Subsidies and Grant Funding*

The Equitable Share is being used to subsidise urban households disproportionately, because water consumption is higher where people have yard or house connections; but there is a higher proportion of poor households in rural areas. In many urban areas, subsidies disincentivise effective revenue management and operational efficiency.

There have been calls to consider raising the minimum amount to address the needs of vulnerable households, and, in particular, to take account of the additional needs of people with chronic illnesses – notably related to HIV / AIDS, and the need for additional water for good hygiene and home-based care. Consideration should be given to whether this is best done through social grants or through subsidized water. Further, in the light of uncertainty around the meaning of Free Basic Sanitation, it has been suggested further that the Free Basic Water allocation should be increased to make provision for water required for toilet flushing in water-borne systems.

Provision of Free Basic Water to poor households is subsidized through the Equitable Share, but there is evidence that some municipalities are not setting aside adequate funding to providing free basic water to the poor, leading to shortfalls in the available budget for operation and maintenance. Should the provision for Free Basic Water in the Equitable Share be funded and allocated differently, perhaps as a ring-fenced conditional grant? Is the current supply-side approach – whereby the provider of services receives the grant, not the beneficiary household – the most effective, or is it

undermining financial transparency and eroding accountability relationships, between household and provider, and financial transparency between the provider and the services authority?

6.4.4 *Revenue management*

Most municipal revenue management systems require substantial strengthening, with a far stronger emphasis on effective revenue collection. Project Consolidate interventions have achieved a number of notable successes, and approaches to strengthen financial and revenue management are now being consolidated and extended under the comprehensive inter-departmental five year local government support programme, which aims to build and consolidate the systems and competencies municipalities need.

Improved revenue management is a core focus area, with increasing emphasis being given to the preconditions for effective implementation of free basic services policy. A number of case studies have been published in accessible formats aimed at municipal officials, which describe successful turnaround strategies in particular municipalities. They provide valuable insights into a situation before, during and after an intervention, with practical tips on how to rebuild trust with local residents; how to target poor and vulnerable households for relief; strategies for improving revenue collection, with a strong emphasis on first improving service quality, and then providing tangible evidence of how service revenue is used to improve and extend service provision and develop new amenities; highlight the importance of reducing non-revenue water, which cost municipalities vast amounts of money and compromise service quality. These successes need to be replicated widely.

6.4.5 *Water Trading and Banking*

The water market, enabled through water trading under the NWA, represents significant opportunities to achieve a number of water resource management objectives through a market approach that significantly reduces the need for government resources (compared to, for example, a command-and-control based approach). A market-based approach can support allocation reform at limited cost to government, to drive technical and economic efficiency, and to align water use and allocation with emerging economic trends. However, an unfettered water market leads to perverse and unwanted outcomes – a water market must be administered and regulated to ensure that government's objectives are supported and to ensure that water trade supports the public interest.

An institutional form of such an administered market is the water bank, where a public institution (the bank) is introduced into the market to facilitate, regulate and administer trade. The institution is introduced into a cap-and-trade environment, where allocable water is capped (and potentially ring-fenced per sector or to reflect government objectives) and trade is enabled within that cap. Such an institution drives government's objectives in water resources management through the market, by utilizing its position in the market as facilitator, trader and regulator:

- as regulator the institution ensures that trades achieve the broad objectives of government in terms of water use and allocation;

- as trader the institution generates revenue through the market to support allocation reform processes; and
- as facilitator the institution supports the market and reduces transaction costs, thereby driving market activity that increase efficiency of use and aligns water use patterns with emerging economic trends.

6.5 *Institutional reform*

This section will look at a range of institutional issues that must be addressed, including legislative issues and mechanisms, and institutional arrangements and governance. It is important that the institutional arrangements provide a strong enabling environment within which water can be most effectively harnessed for Water for Sustainable Growth and d Development. There are a number of aspects to this which are outlined below.

6.5.1 *Reform of Water Management and Water Services Institutions*

Institutional reform is needed across the water sector to overcome fragmentation, strengthen accountability and consolidate capacity to support social transformation and economic growth. There are more than 300 public institutions in the water sector, excluding water user associations. The pool of available sector expertise cannot support this vast number, and the overheads costs are inappropriately high. At issue is how best to leverage available capacity to strengthen sector performance, in ways that maximize scale economies and promote good governance.

At the watershed level, DWAF is already reconsidering the number of catchment management agencies to be established. The challenge it is to maintain stakeholder involvement at the catchment level, while optimizing the number of actual CMAs. Reducing the number from the original 19 will enable more effective use of limited resources and reduce the regulatory burden on the state.

Water services require professional management, yet most municipalities are unable to attract or retain the necessary professional skills required, straddling financial and technical expertise. Reliable service delivery to key industries and its cities - engines of growth - is increasingly under threat from decaying infrastructure and weak management.

Nationally, just eight out of 169 WSAs have ring-fenced their water services finances fully; seven of these are served by an external provider, indicating that contractual arrangements drove ring-fencing, rather than the requirements of sound management. A further 17 are partially ring-fenced, but sound management is unlikely if the total costs of service provision, including asset management, are not known or managed against income. Strong emphasis on the economic and financial dimensions of water services management is necessary if the current deterioration of the asset base and declining service quality in many areas is to be reversed.

There is scope to consolidate existing provider capacity into regional entities, serving more than one WSA, or a municipality could consolidate all its operating staff and assets into a single municipal-owned entity, as Johannesburg and Moluti-a-Phofung have done. Particularly in dispersed rural settlements, a municipality could

consolidate provider arrangements through one entity, whether public or private or community-based.

Comprehensive and onerous Section 78 assessments are needed before any external provider arrangement can be considered. The Municipal Finance Management Act prohibits the sale of any public assets required for basic service delivery, and the Municipal Systems Act makes any form of lease or concession difficult. However, there are now a growing number of public-public arrangements between municipalities and water boards, facilitated by the same two Acts which allow municipalities to bypass standard supply chain management processes if they wish to contract water boards. It may be necessary to consider whether the burdens of private sector involvement are too onerous, and whether water boars should not be subject to competitive tender to safeguard the interests of consumers and WSAs.

Move swiftly to establish the NWRIA
Handover of responsibility from DWAF to the National Water Resources Infrastructure Agency should be managed carefully to avoid delaying critical infrastructure developments, notably the proposed Crocodile-Lephalale supply to the Waterberg coalfields, energy and synfuel developments. The much-needed revision of GWS operation and maintenance systems and procedures should not be deferred until the NWRIA is established; consolidation of good practice before the handover will help to equip the new Agency with systems it requires for effective functioning from inception.

Strengthen alignment within DWAF
Historically there has been a separation between the water services and water resources functions within DWAF, resulting in an unfortunate gap in alignment, understanding and processes between the two. Focusing on Water for Sustainable Growth and Development provides an opportunity for DWAF to develop a much stronger interface between the two, so that planning, regulation and management cover the whole water continuum seamlessly and more efficiently. The opportunity also enables DWAF to examine and consolidate its new role in relation to policy maker, oversight, information management, and national water resources planner, rather than hands-on manager of water.

It also provides an opportunity to put in place a process to decide on the most appropriate institutional arrangements for regulation of the water sector. The improvement of regulatory capacity is dealt with in 6.5.5 below.

6.5.2 *Reducing the cost of starting a business*

A high cost of doing business has been identified internationally as one of the constraints to economic growth. The requirement for a license to use water or to discharge effluent is part of the regulatory framework for any business or industry wishing to use raw water or discharge to a water resource. Delays in obtaining such authorization add substantially to the cost of starting a business. Although considerable work has been done to speed up the time taken to issue a license by DWAF, it can take from months to years to obtain a license, partly due to the nature of the authorization process that has been put in place, and partly due to lack of

capacity.. Such constraints impact on both small and large enterprises, costs jobs and incur significant opportunity costs. .

6.5.3 *Improving regulatory capacity*

Regulatory capacity in the water sector is poorly developed. A draft Water Services Regulation Strategy is nearing finalization, and sector debate is now broadening to explore appropriate mechanisms and vehicles for regulation across the sector as a whole. If Water Services regulation is a sub-set of sector regulation, how best should the institutional mechanisms of water services and water resource management regulation align? There are a number of areas of regulation, which may require different capacity and institutional arrangements, such as regulation of water quality, regulation of tariffs and price.

The roles, responsibilities and functions of different sectoral role-players need to be unpacked. Establishment of the National Water Resource Infrastructure Agency will allow a structural separation between raw water provision, pricing and regulation, separation of regulatory functions is more complex. At what point does the allocation of a permit or license, for example, cease to be a resource management function, and become a component of sector regulation? What are the limits of a CMA's regulatory powers? An effluent discharge permit is implicitly a contract between the authority (DWAF, or the CMA) and the operator. Who determines the license terms and conditions, and who imposes penalties when they are breached? Does 'the regulator' engage only with key performance outcomes, as specified in the permit or license? Where does the boundary lie between performance monitoring, 'supervision' and 'regulation'?

Equally, there is a challenge in separating the functions of government as shareholder in water management institutions, and government as regulator of water institutions. A key question in this regard is what the legal powers of the Minister of Water Affairs and Forestry are in terms of regulation and intervention. Her powers are much stronger and more direct in terms of the National Water Act than in the water services sector, which poses significant challenges for regulation of that sector.

The Presidency is said to be exploring a possible multi-sectoral Economic Regulator and the water sector needs to give consideration as to whether it is feasible or desirable to incorporate the economic regulation the water sector into such a multi-sectoral Economic Regulator.

Ideally, regulatory activities and decisions should be supported by a set of guidelines or regulations which are well understood by authorities, service providers, consumers, citizens, and, where relevant, to investors. Decisions should be transparent and publicly available and defensible, whether the regulatory powers were vested in an independent regulator, a ministerial agency, or a contract.

'The Regulator'
In the water services sector, the emphasis on 'developmental regulation' blurred the distinction between support, intervention and enforcement, as DWAF partially assumes accountability for provider performance through its support activities.

Enforcement activities are critical to providing incentives for water providers to perform their roles, and a more differentiated approach to regulation is warranted, with firm action taken against municipalities who have the means to perform better. This raises important questions about the location of the regulator – within or outside of DWAF – and to whom it accounts.

WSAs as regulators

Water services policy distinguishes between an authority and provider function at local government, and the draft Water Services Regulation Strategy is premised on the WSA being able to regulate the performance of its WSP, ideally through a contract which specifies performance targets. But the vast majority of WSPs are internal – the technical services department of the municipality - and there is seldom a separation of WSA and WSP roles. The separation of functions is only evident where a separate institution – another municipality, a Water Board, or a municipal-owned entity – fulfils the role of WSP. Few municipalities with internal WSPs have sufficient staff to separate the WSA and WSP functions, and it is generally municipal councilors who frame policy, set targets and hold service departments to account; this approach does not necessarily serve the best interests of 'customers' or the resource base, and falls short of the regulation the sector requires.

This conflation of authority and provider roles compromises key assumptions and mechanisms of the regulation strategy, and may warrant review, as the gap between the conceptual and policy framework and sector practice remains wide.

6.6 *Integrated planning*

6.6.1 *Planning for redress and transformation*

Although great strides have been made in this area, there is still a need to improve alignment between water planning at national and local level and economic and social transformation planning. There is also a need to ensure the mainstreaming of poverty, gender and HIV/AIDS concerns into water planning. A huge opportunity exists to harness groundwater potential to support redress and transformation.

6.6.2 *Integrating economic and development planning with water planning*

From the perspective of ensuring that water supports sustainable growth and development, the challenge is ensuring the integration of water resources and water supply planning into all government planning, from the NSDP to the IDPs, and across all government departments and agencies of government.

DWAF is responsible for water resources planning, while water supply and sanitation planning is the responsibility of water services providers, under the leadership of designated water services authorities. Water Boards play a role in planning of bulk water services provision, along with DWAF and municipalities. Increasingly, Catchment Management Agencies will play a role in catchment level planning. There is thus a complex array of institutions responsible for planning in the water sector that must engage effectively with the planning of an equally complex array of departments, spheres of government and government agencies. As demands on water increase, and the impacts of pollution and habitat destruction increase, the need for

integrated planning that includes water availability as a key input to all growth and development opportunities becomes more critical.

This planning takes place within an international framework, where international agreements reached under the SADC Protocol on Shared Water Resources determine how much water must be released for riparian states.

Water and energy planning
Water is a key input to power generation in South Africa. In 2007 Eskom reported that is used approximately 1.9% of the annual water consumption in the country. Eskom tracks water usage as a performance measure, and, as can be seen in **Error! Reference source not found.**, specific water consumption (in litres per kilowatt-hour) has been steadily rising from 2004 (1.26) to 2007 (1.35).

From a sectoral planning perspective, the integrated energy modeling initiative by the Department of Minerals and Energy (DME) is a step in the right direction. In terms of the conceptual framework of the National Integrated Energy Modeling System (NIEMS), water supply as an enabler of, or constraint on, project development and operational issues in the energy sector, has correctly been identified as an area that requires detailed, scientific modeling.

In terms of this approach, therefore, the Water Supply Module will be used to model the key variables in this sector, including water availability from various sources and the quality thereof. In addition, interactions between this and other modules, such as Renewable Fuels, Coal Supply, Electricity and Petroleum, and Climate Change, will be modeled.

Importantly, where the modeling requirements are already being met via existing systems and processes, the aim will be to define interfaces with such systems and processes and thus avoid duplication. It can be concluded, therefore, that for this approach to be effective, co-operative arrangements between the DME and DWAF will be crucial, the main purpose being to ensure that planning within these sectors takes into account the inherent inter-dependencies.

6.6.3 *Planning for WC/WDM*

The National Water Conservation and Water Demand Management Strategy developed by DWAF in August 2004, is the cornerstone for WC/WDM planning. All water institutions need to demonstrate how the principles of WC/WDM have been included in water planning decisions.

The challenge is to ensure, at all levels in the water sector, that WC/WDM is not only planned for, but budgeted for and implemented. DWAF needs to play a stronger role in regulating and enforcing efficient water use.

6.6.4 *Integrating environmental planning into water planning*

Environmental considerations must be incorporated into all water planning mechanisms and tools so that the environmental impacts of decisions on the resource base and aquatic ecosystems are considered. Currently, there are excellent policies in

place to ensure that the resource is protected and that the negative impact of future development is limited, but the implementation of these policies remains a challenge. For instance, while the "polluter pays principle" is recognised as a very effective way of controlling negative environmental impacts on the resource, the principle has yet to be implemented. Similarly, while the integration of environmental planning into large infrastructure planning has been relatively successful, there are major challenges at the local level in achieving the same level of integration.

One of the key challenges is to understand the cumulative abstraction and discharge impacts across a catchment and to be able to plan and manage accordingly (including the issuing of licenses). Strategic environmental assessment (SEAs) and environmental management frameworks (EMFs) may be useful in this regard, particularly in alignment with the development of Catchment Management Strategies.

7 Actions and targets

This section will deal with the key strategic actions that must be taken to ensure that the sector is able to deliver WfSGD now and in the future. The actions link to each of the opportunities raised in the previous section. This section will be completed on the basis of the consultative process.

Appendix A

Prince Albert: Another example of the need for groundwater management

Prince Albert is a small town at the southern edge of the Great Karoo. Their water use ranges between 1 000 – 3 000 m^3/day depending on the time of the year, and most (80%) of this comes from groundwater. Up until 2006 when a groundwater management project was initiated through Masibambane, the town experienced water shortages every year. Each summer, the pump operator reported that boreholes ran dry, and one by one, they had to be de-commissioned until only the few 'stronger' boreholes could be used. As the summer progressed, higher levels of water restrictions would be implemented, and in some years water shortages had significant impacts on small farms and industry that depended on municipal water supplies.

This situation was turned around within a year. Numerous options, ranging from dams to collector wells, were proposed to the municipality, but it turned out that no new water sources were necessary. There was enough water – it just had to be managed properly. In the winter of 2006 intensive water level and abstraction monitoring was initiated, and before summer, hydro geologists analysed the data and effected operational changes. Pumping rates were lowered and pumping times were extended. **More water** was abstracted from the boreholes than ever before, and that summer there was no need for water restrictions. The summer of 2007 was exactly the same – there was no water shortage.

So what happened? Drillers, pump installers, local diviners, and others who may know little about the science of groundwater recommend long-term borehole pumping rates, and in virtually every case, they over-estimate sustainable yields. They also do not understand the value of on-going monitoring and management. These are the biggest cause for the false perception that groundwater is unreliable. Groundwater is actually more reliable than surface water as it flows slowly through the subsurface and is thus less vulnerable to variable weather and the effects of climate change. Like the rest of most groundwater users in South Africa, Prince Albert suffered from a lack of management, not a lack of water. The abstraction rates of the Price Albert boreholes were modified so that the water table dropped more evenly throughout the aquifer rather than the localized 'hammering' that was previously applied to the aquifer.

A bonus of the new monitoring system is that it is now evident that an even higher level of water security can be achieved with artificial recharge. Conjunctive use of surface- and groundwater is being planned to ensure the aquifers are always full prior to the onset of the summer months.

There are hundreds of other 'Prince Alberts'. If all groundwater users chose to optimize the use of aquifers, and where feasible, integrate surface- and groundwater, far fewer new schemes would be needed.

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