INLAND WATER AND WATER SUPPLY

INTRODUCTION

South Africa is a water-stressed country and is expected to experience chronic water shortages by 2025. The Western Cape is one of the drier provinces in South Africa, and receives approximately 350 mm of rainfall per annum, well below the national average of 500 mm per annum (DWAF, 2004). The majority of the Western Cape receives rainfall during the winter months, while demand for water is highest during summer when rainfall and river stream flows are low.

The Western Cape contains three entire river systems, the Breede, Berg and Gouritz, and portions of the Olifants and Buffels systems. There are five Water Management Areas (WMAs) within the Western Cape Province, namely: the Berg, Breede, Gouritz, Olifants/Doorn and the far western portion of the Fish to Tsitsikamma (see Figure 5.1).

All five WMAs in the Western Cape have active water transfer schemes within them (DWAF, 2004) and the flow patterns of most rivers have been altered due to the presence of dams and weirs, water abstraction, return flows to rivers and other impacts of land use activities. This, combined with the pressing need for further social and economic growth in the province, emphasises the need for careful management of all water resources.

As opposed to most other South African provinces, the Western Cape is relatively well endowed with groundwater resources. The sustainable harvest potential of the province's aquifers is approximately 3.2 million m3 per annum (Baron et. al., 1998). The harvest potential is highest in the southern areas of the province that form part of the Table Mountain Group. It is lowest in the extreme north-west of the province.

Three priority issues for inland water and water supply have been identified for this report. These are:

- Pollution and degradation of rivers, wetlands and estuaries;
- Increasing demand for water in a water-poor environment; and
- Access to potable water.

DRIVERS AND PRESSURES

Some of the driving forces and pressures that influence the state of inland water and water supply in the Western Cape include:

Population growth and economic development – population growth and increasing economic development in the Western Cape has resulted in higher domestic, agricultural and industrial demand for water, which places increasing pressure on limited water resources.

Inappropriate planning - encroachment of urban development into floodplains and wetlands results in the destruction and pollution of river ecosystems. Additionally, lack of co-ordinated planning for the northward expansion of the Cape Metropolitan Area has led to inadequate capacity for the provision of water supply and sanitation services.

Land-use policies – Poor land use policies that have encouraged urban sprawl result in an increase in impervious (hard) surfaces. This increases the runoff and pollution that reaches wetlands and rivers, and ultimately the ocean, and limits recharge of groundwater sources.

Encroachment of invasive alien vegetation and fauna - Invasive alien vegetation uses more water than the natural vegetation it replaces. Also many alien fauna out-compete endemic freshwater fish species.

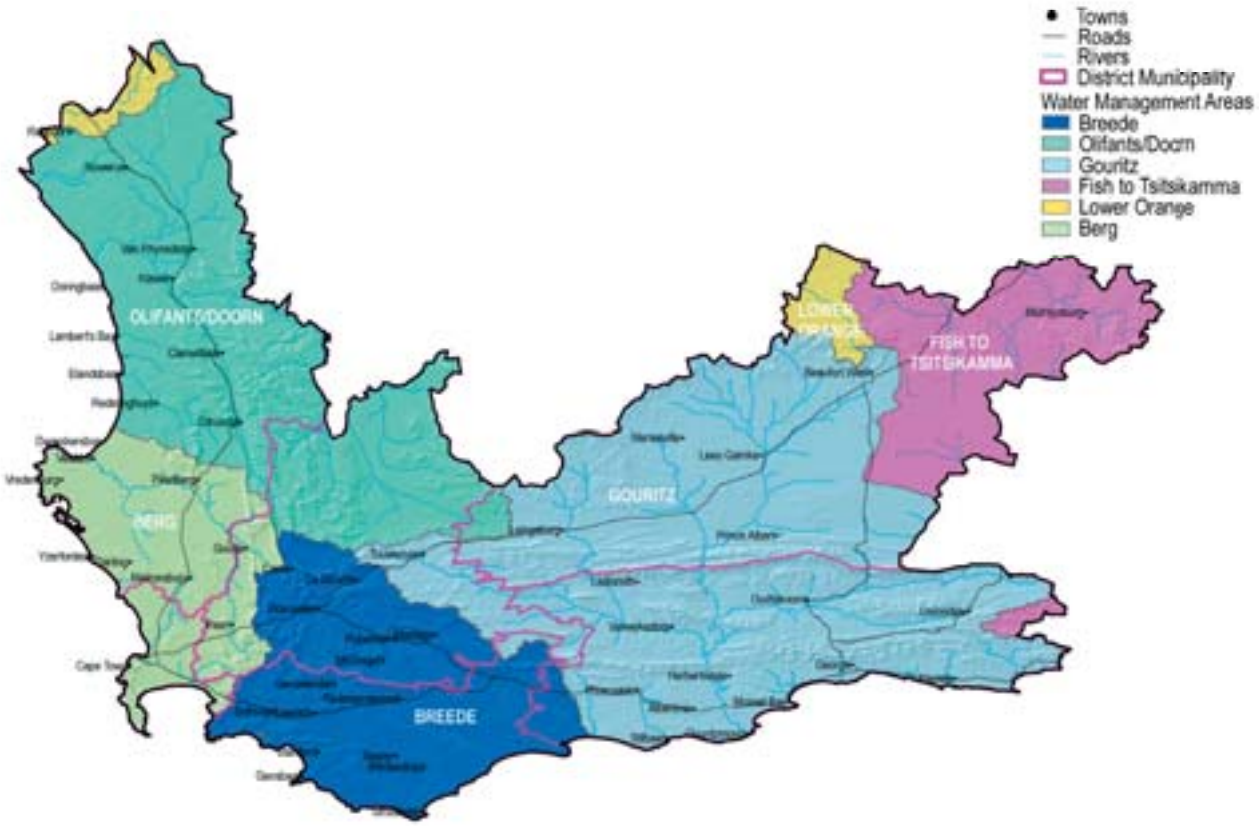
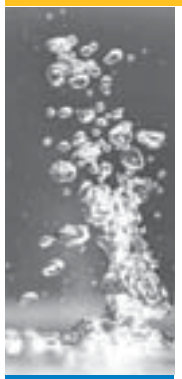


Figure 5.1: Water Management Areas of the Western Cape *(Source: DWAF, 2004)*

Increasing pollution – Major sources of water pollution are agricultural run-off (fertilisers and pesticides) and return flows[14], urban run-off and effluent discharges (bacteriological contamination, salts and nutrients), industries (chemical substances), mining (acids and salts) and areas with insufficient sanitation services (microbial contamination). Groundwater pollution is caused by mining activities, as well as seepage from landfills, human settlements and the intrusion of sea water in the coastal zone.

Over-utilisation of riparian zones – Riparian buffer zones are a crucial component of water systems, stabilising river banks, filtering nutrients and sediments, providing habitat and reducing the impacts of flood events. River function is compromised when cultivation, construction, alien vegetation encroachment and sedimentation occurs in the riparian zone. Loss of wetland health and biodiversity in the river catchments also affects water yield.

14. Return flow is drainage water from irrigated farmlands that re-enters the water system to be used further downstream.



Poor or inappropriate regulation of flows and water abstraction – Dam walls and weirs prevent the natural movement of fish and other aquatic species, while regulated flows eliminate seasonal flow variations and have adverse impacts on the resilience of river systems. Reduced water levels reduce the diversity and availability of aquatic habitats.

Lack of co-operative management – a lack of co-operation between various government departments and a lack of integrated planning are serious constraints to good catchment management in the Western Cape.

ISSUE: POLLUTION AND DEGRADATION OF RIVERS AND WETLANDS

Riverine landscapes are a vital component of the environment that provide important ecosystem services such as clean water, energy, and transport (Vitousek et. al. 1997). However, most of the world's large freshwater ecosystems are currently threatened and subjected to some major form of alteration or deterioration. This trend is largely attributable to human activities such as river engineering schemes, catchment mismanagement, etc. (Dollar, 2000). In South Africa, the conservation status of freshwater ecosystems is poor and declining fast, with very few rivers retaining their original functional or ecological integrity (Nel et. al. 2004).

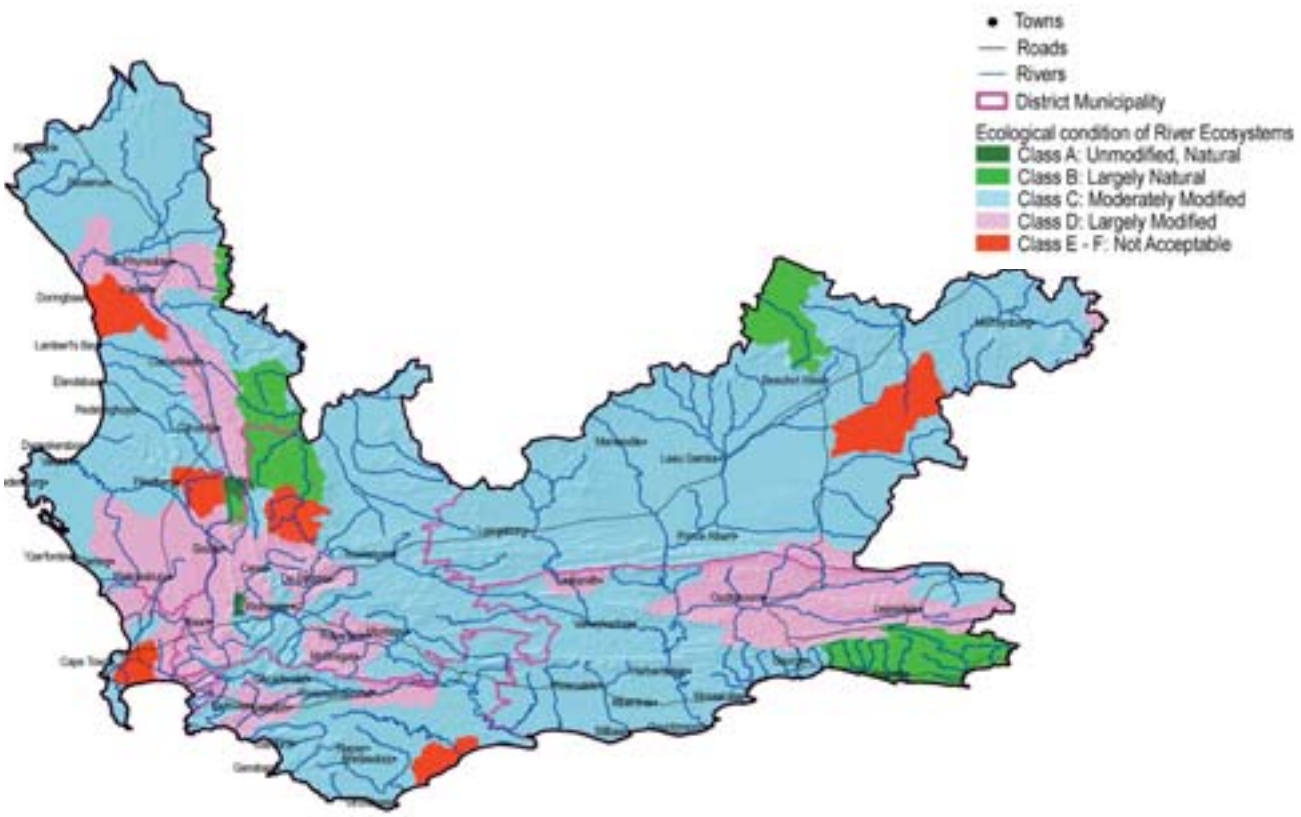


Figure 5.2: Ecosystem stystems of the river ecosystems in the Western Cape *(Source: Nel et al. 2004)*

The pollution and degradation of water resources creates many problems. Increased water temperature, sediment loads and turbidity levels have adverse impacts on aquatic life and the recreational value of inland water, and cause an increase in the costs of treating such waters for potable use. Increased levels of dissolved salts render water unfit for use or very costly to treat for irrigation and household use. Cyanobacteria (often referred to as blue-green algae) are toxic and, when present in large numbers, make water unfit for irrigation and recreational and domestic use. Pollution by metals and manufactured organic components such as herbicides and pesticides also has serious impacts on human and animal health. Microbial contaminants contain pathogenic organisms that cause water borne diseases such as diarrhoea and cholera. Unsuitable farming practices, like stock grazing within the riparian belt and excessive use of pesticides and fertilizers, have negative impacts on water quality and habitats for biota.

STATE

Remaining intact river length in relation to conversation targets (i.e. status of river ecosystems)

River ecosystem status was derived based on the extent of remaining intact (natural or near-natural) river length of each main river ecosystem, in relation to its conservation target (Nel et. al. 2004). Main river ecosystems were combined spatially

with river integrity data to calculate the intact length of each main river ecosystem. Intact length was compared to the total length of each main river ecosystem to derive conservation status categories of each ecosystem, where:

- Least threatened river ecosystems have an intact stretch that's length is greater than 60% of their total length;
- Vulnerable river ecosystems have an intact stretch that's length is greater than 40% of their total length;
- Endangered river ecosystems have an intact stretch that's length is greater than their conservation target (in this case, 20% of their total length) and
- Critically endangered river ecosystems have an intact stretch that's length is below their conservation target (in this case 20% of their total length).

Figure 5.2 demonstrates the critical condition of the main river ecosystems of the Western Cape and shows that all the ecosystem types of the province's main rivers (excluding most tributaries) are threatened. This means that they run the risk of irreversibly losing the ability to support their biodiversity heritage (natural river habitat, plants and animals). Just over 75% of the province's main river ecosystems are critically endangered. These ecosystems have lost so much of their original natural habitat that ecosystem functioning has broken down and species associated with the ecosystem have been lost or are likely to be lost. This loss, in many cases, is likely to be irreversible. These critically endangered river ecosystems are located throughout the province. The remaining main river ecosystems are either endangered (19%) – these are concentrated in the west of the province with some in the south east – or vulnerable (5%), which are mostly coastal rivers in the west and far south east (Nel et. al., 2004)

These results are based on an assessment of the main rivers only, and ignore the conservation potential of numerous tributaries within catchments where the main river is not intact. This highlights the importance of tributaries for conserving biodiversity patterns. In many instances, these tributaries could be viewed as refuges for aquatic biodiversity.

The need for urgent attention to be given to the state of river biodiversity in the province can be highlighted by comparing the river ecosystem status to terrestrial ecosystems (compare Figure 4.2 and Figure 5.2). The comparison demonstrates that the state of terrestrial biodiversity in the province, despite being in need of attention, is far better than that for river ecosystems. This data reflects the current state of rivers in the Western Cape. The state of rivers will have to be monitored on an on-going basis for trends to be established and in order to establish if initiatives that have been put into place are being effective.

Change in ecological status class of rivers and wetlands (based on the River Health Programme)

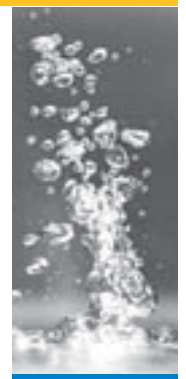
The River Health Programme (RHP) was initiated in 1994 by the Department of Water Affairs and Forestry. The programme was developed with the overall goal of expanding the ecological basis of information on aquatic resources, in order to support the rational management of these systems. (Roux et. al., 1999). In the RHP, a multitude of factors (indices) determine the health of a river ecosystem, including its geomorphological characteristics, hydrological and hydraulic regimes, chemical and physical water quality, and the nature of instream and riparian habitats. River health categories are classified as natural, good, fair and poor (Roux et. al., 1999; 2004).

A category of *natural* generally represents an unmodified river system, while a category of *poor* represents a very highly modified system. Presently, eight State-of-Rivers Reports have been published in the country. In the Western Cape Region detailed biological monitoring has been done on all the major rivers in the Cape Metropolitan Area as well as on the Berg River. In the case of the Diep and the Berg rivers, RHP monitoring results indicated that the water quality, habitat integrity and flow in these river systems are severely impacted. Similar results were also obtained for most of the rivers in the province (RHP 2004; 2005).

An overall picture of the River Health for the Western Cape is not yet available. Table 5.1 contains a summary of the currently available information. The ecological status indicates the change of the river systems from a natural state.

Table 5.1: Range of ecological status for rivers in the Western Cape (*RHP 2003a, 2003b, 2004)*

River system	Ecological status
Klein Brak system	Some natural tributaries and moderately modified systems
Hartenbos	Moderately modified
Berg system	Some natural tributaries and moderately modified systems
Diep	Mostly fair to modified systems
Hout Bay	Some natural tributaries and moderately modified systems
Lourens	Some natural tributaries and moderately modified system
Palmiet system	Some natural tributaries and moderately modified systems



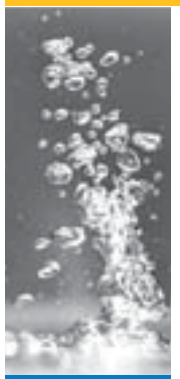


Table 5.2: Exceedance of South African Water Quality Guidelines for Domestic, Irrigation and Recreational Use in the Western Cape Province *(Source: DWAF, 1996)*

Water Management Area	Domestic use							
	F	TDS	Ca	Mg	SO_4	Cl	Na	K
Gouritz		X	X	X	X	X	X	X
Olifants / Doring								
Breede						X		
Berg								
Water Management Area	**Irrigation use**							
	SAR		EC		pH		Cl	
Gouritz	LM		H		(-)		H	
Olifants / Doring								
Breede			L				L	
Berg								
Water Management Area	**Recreational Use**							
Gouritz								
Olifants / Doring								
Breede	X							
Berg								

Domestic use: X indicates that the water quality indicator is outside the ideal range for domestic use at some locations in the water management area. F = Fluoride; TDS = Total dissolved salts; Ca = Calcium; Mg = Magnesium; SO_4=- Sulphate; Cl = Chloride; Na = Sodium; K = Potassium.
Irrigation use: A symbol indicates that the water quality indicator is outside the target water quality range for irrigation use at some locations in the water management area, where L, M and H means Low, Medium or High risk, (+) = alkaline and (-) = acidic. SAR = Sodium Adsorption Ratio; EC = Electrical Conductivity; pH = a measure of acidity/alkalinity; Cl = Chloride; b = Boron.
Recreational Use: X indicates that the water quality indicator is occasionally outside the acceptable levels for recreational use at some locations because toxic cyanobacteria have been found.

Exceedances of South African Water Quality Guideline levels of nitrates, phosphates and faecal coliform bacteria.

Table 5.2 indicates, for various water uses, exceedances of water quality guidelines for the five WMAs in the Western Cape (DWAF, 2004). Within the CMA, increased urbanisation in its ten major river catchments has had adverse impacts on the health of its rivers, wetlands and vleis. Six of these catchments currently receive effluent from sewage treatment works.

Measuring the levels of pollutants in the environment indicates the potential effects that contaminated water will have on people and ecosystems. The data used is derived from the South African Water Quality Guidelines monitored and measured by the Department of Water Affairs and Forestry. The effects are measured as acute effects (Acute Effect Value) or chronic effects (Chronic Effect Value) in relation to target water quality ranges (DWAF, 1996).

Tables 5.2 shows that the Gouritz System does not meet most of the water quality standards and is at unacceptable levels for domestic and irrigation use. The Breede system has unacceptable levels of chlorides, with low risk to irrigation use and is outside of the acceptable levels for recreation due to the presence of toxic cyanobacteria (bue/green algae). According to these data the Berg system does not exceed any of the measured water quality variables.

Number and Location of Wetlands in the Western Cape

Wetlands offer a range of ecological services, such as flood attenuation, groundwater recharge and sediment control, and also act as natural filters by trapping pollutants. Wetlands are biologically productive and can be important centres of endemism. Some Western Cape wetlands are registered protected areas, including World Natural Heritage Sites and Ramsar Sites, e.g., Rietvlei and Langebaan Lagoon.

Figure 5.3 indicates the number and location of wetlands and Ramsar Sites in the Western Cape.

IMPACTS

- The decline in the quality and flow of rivers results in the deterioration of the Western Cape's coastal wetlands and estuaries.
- Increased deterioration in the ecological condition of rivers causes a rapid decline in the potential of river systems to provide water and services to people.
- Dams and weirs inhibit the migration of fish and invertebrate species making them susceptible to predation, poaching and species loss (RHP 2004).
- High levels of *E coli* bacteria can cause gastric illness.
- Increased contamination leads to increased costs of treating water to meet acceptable water quality standards.
- Microbial contamination from sewage or an absence of sanitation services causes water borne diseases such as diarrhoea and cholera.
- High levels of nitrates and phosphates in water cause eutrophication and a decline in water quality, which results in a rise in water treatment costs.

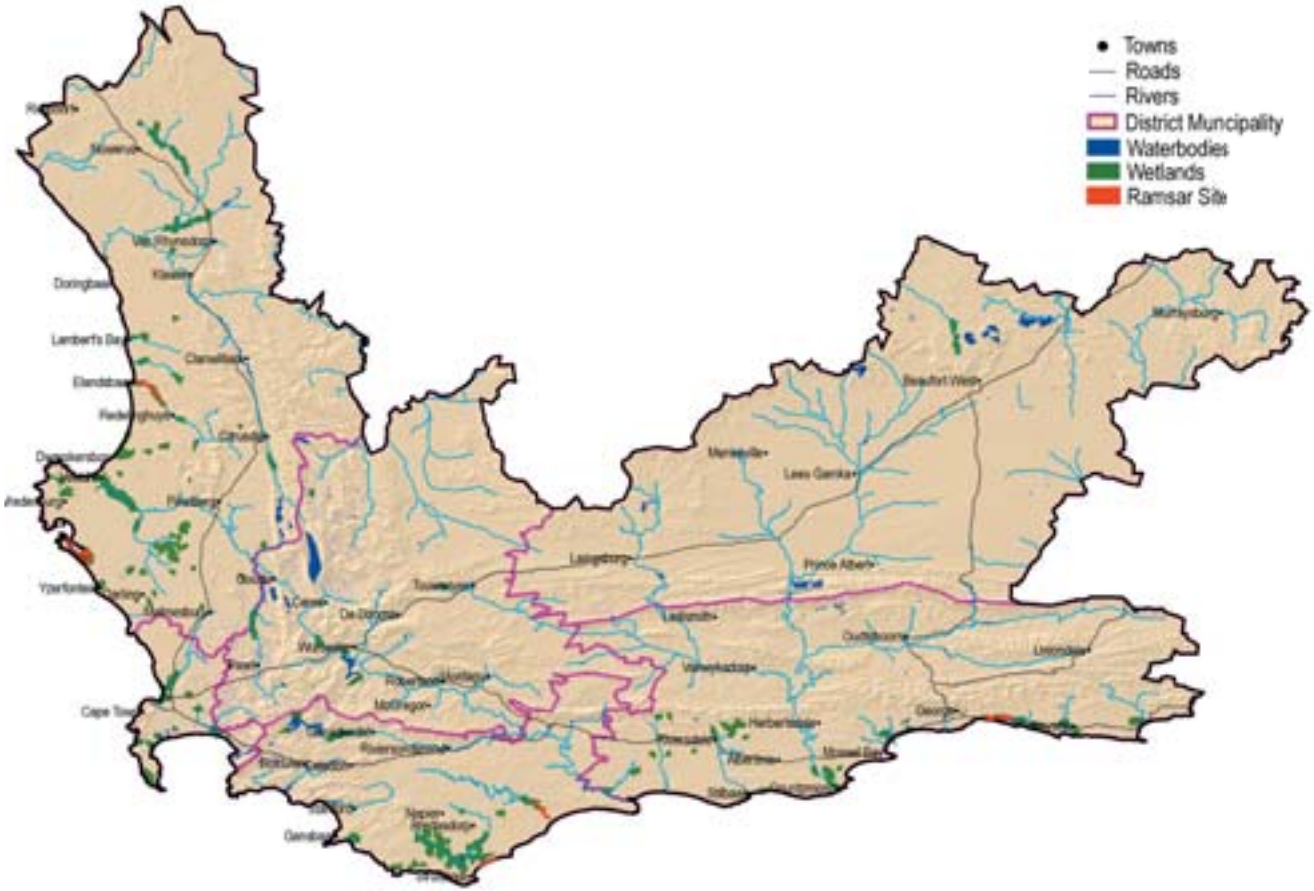
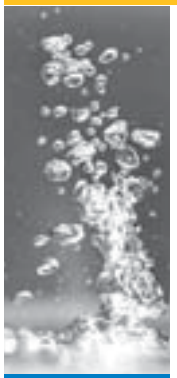


Figure 5.3: Wetlands and dams within the Western Cape Province *(Source: DWAF, 1996 and 2001)*

ISSUE: INCREASING DEMAND FOR WATER IN A WATER-POOR ENVIRONMENT

Water is a national asset and the DWAF is responsible for ensuring that our limited water resources are fairly and reasonably distributed and that water is used wisely for social and economic development (DWAF, 1988). Water demand in South Africa has been growing at around 4.5% per annum since the 1930s (McKenzie, et. al., 1999). This is leading to a serious conflict between the need for water for the ecological functioning of freshwater systems and the need for water by the various sectors (domestic, industrial etc.). Water supply and yield is strongly linked to, and dependant on, biodiversity. Healthy and functioning wetlands and indigenous catchment areas are essential for water yield.

Currently very little water is being re-used in the Western Cape. Only about 8% of water used in the Cape Metropolitan Area is recycled. Water can be directly recycled for re-use or returned to rivers after treatment, thereby becoming available for re-use further downstream.



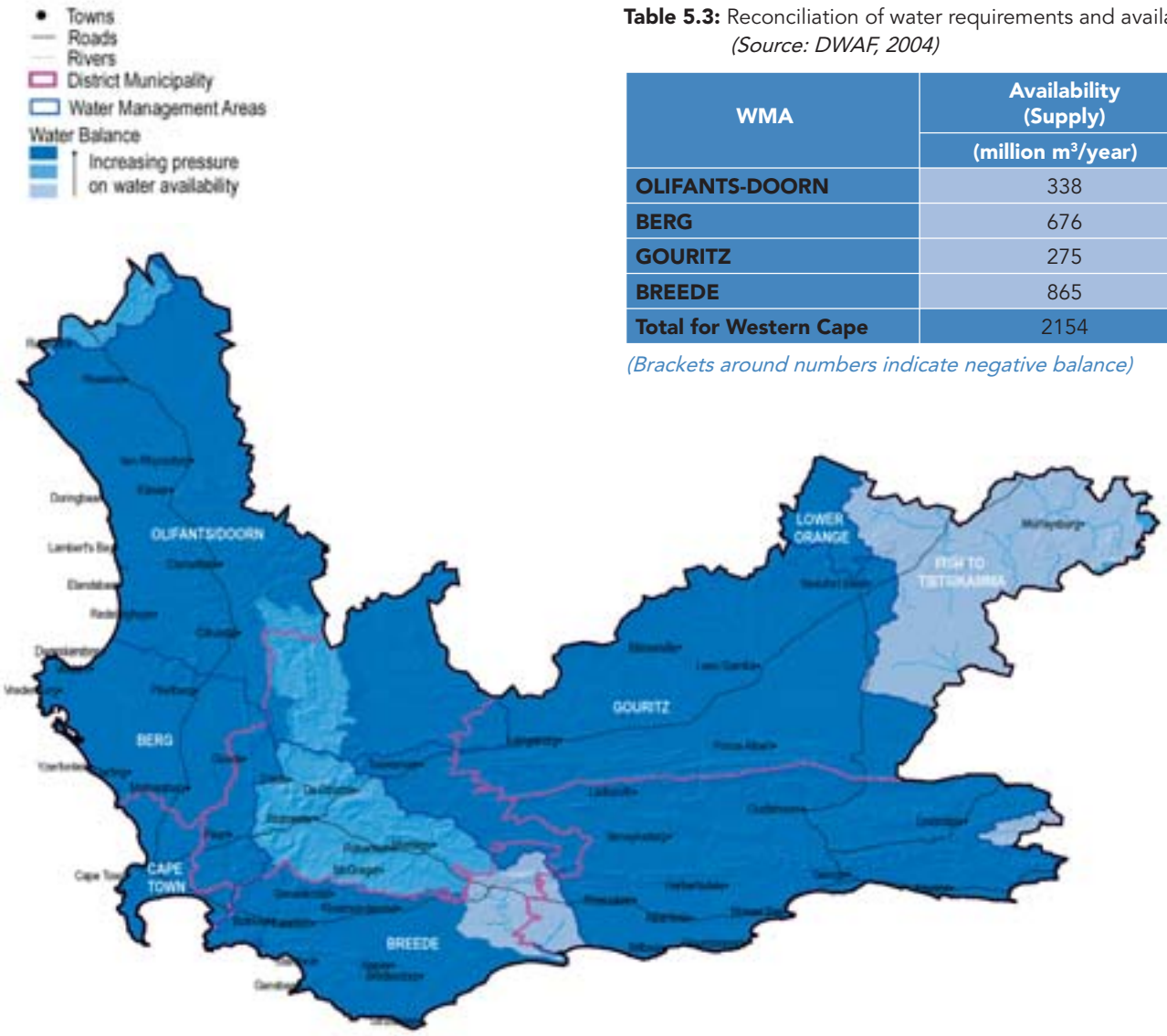


Figure 5.4: Water Balance *(Source: DWAF, 2004)*

Table 5.3: Reconciliation of water requirements and availability in the Western Cape WMAs for the year 2000 *(Source: DWAF, 2004)*

WMA	Availability (Supply)	Requirements (Demand)	Balance (Supply-Demand)
	(million m^3/year)	(million m^3/year)	(million m^3/year)
OLIFANTS-DOORN	338	373	(35)
BERG	676	704	(28)
GOURITZ	275	339	(64)
BREEDE	865	828	37
Total for Western Cape	2154	2244	(90)

(Brackets around numbers indicate negative balance)

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Total water available versus water used per annum

Table 5.3 and Figure 5.4 show that, except for the Breede WMA, annual water demand in the Western Cape WMAs exceeds availability. The sub-areas within the WMAs with the greatest requirements are the Olifants and Upper Breede (agriculture), Greater Cape Town (urban), and Upper Berg and Riviersonderend (water transfers out of the catchment). The Riviersonderend/Berg River Government Water Supply Scheme is an inter-basin transfer scheme from the Riviersonderend in the Breede WMA to the Berg and Eerste Rivers in the Berg WMA.

Inter-catchment transfers are one way in which the province is trying to manage the supply and demand of water. For example, in the Cape Metropolitan Area demand will soon outstrip the water resources available in the Berg River WMA and water from the Breede River may need to be used to meet Cape Town's future needs. However, this solution would incur opportunity costs, as less water would be available for irrigated agriculture in the Breede River WMA.

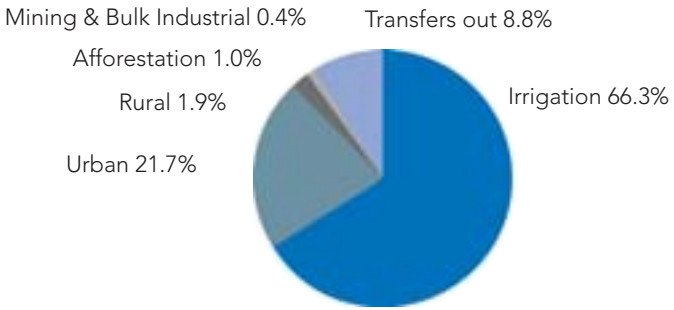


Figure 5.5: Total surface water used per sector in 2000 for Western Cape *(Source: DWAF, 2004)*

Total water used per sector

National patterns of water use are mirrored closely in the Western Cape. Nearly two thirds of available water in the Western Cape Province is used for irrigation, followed by urban requirements – especially for the Cape Metropolitan Area (Figure 5.5). Water use differs across WMAs. Water from the Olifants/Doorn WMA area is used almost exclusively by the irrigation sector (approximately 95%), while some 2% is required for urban and industrial use, 2% for rural domestic supplies and stock watering, and less than 1% for mining. The Cape Metropolitan Area Metropolitan area falls within the Berg WMA, where close to 60% of the total water is destined for urban and industrial use, and 40% for irrigation. Importantly, the Berg WMA contains about 50 conservation and heritage areas that also rely on water supplies.

IMPACTS

Limited water resources and the continuing increase in water demand can have the following impacts:

- There is likely to be insufficient water supply for both industrial and domestic users, which means economic (especially agricultural) opportunities may be lost.
- Over exploitation of water resources will lead to insufficient water being available for the natural functioning of the freshwater systems. They therefore cease to function effectively and the environmental services they provide will be lost.

ISSUE: ACCESS TO POTABLE WATER

Access to potable water is critically important for human health and well being. Target 10 of the Millennium Development Goals is to "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation" (UNMD, 2002).

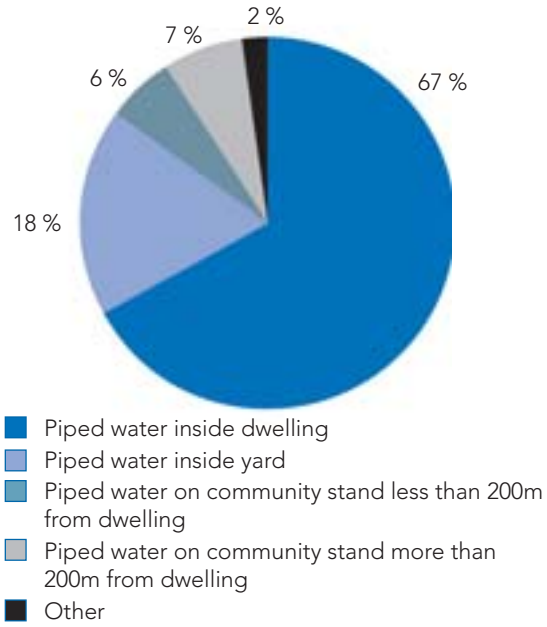


Figure 5.6: Access to potable water per percentage of the population in the Western Cape *(Source: Stats SA, Census 2001).*

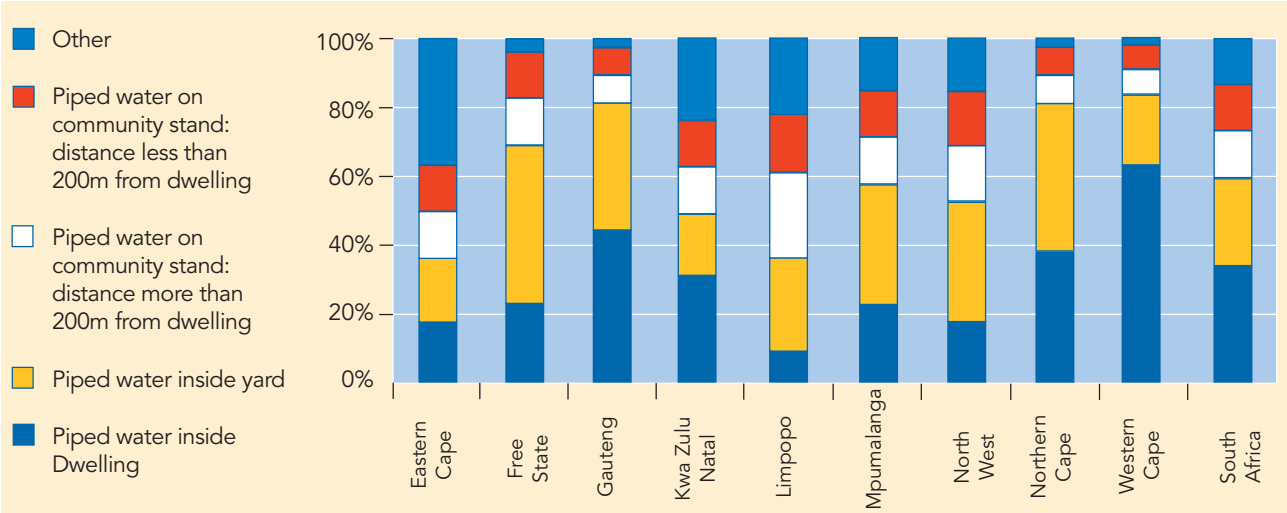
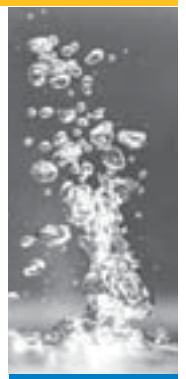
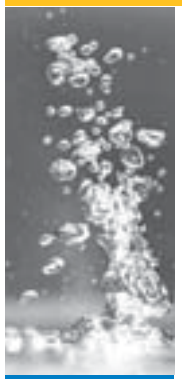


Figure 5.7: Potable Water to dwellings per province *(Source: Stats SA, Census 2001).*





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Percentage of households with piped potable water to dwellings

In South Africa, the Western Cape has the highest proportion of dwellings with piped water inside dwellings (67%), far higher than the national average of 32%. However, there is still a need to provide additional supplies of potable water to several rural and urban areas of the Western Cape (Stats SA, Census 2001).

Figure 5.6 gives an indication of the percentage of the population that has access to piped potable water in the province and Figure 5.7 gives a comparison between the Western Cape and other provinces. In both figures "Other" includes Borehole (0.11%) Spring (0.03%), Rain-water tank (0.15%), Dam/pool/stagnant water (0.16%), River/stream (0.15%), Water vendor (0.05%) and other uses (1.05%).

IMPACTS

- Reliable and sustained access to potable water, whether through direct provision or improved ability to afford it, will protect human health and reduce infant mortality.
- The spread of some diseases such as cholera and diarrhoea is exacerbated by poor access to potable water.
- Easy access to potable water allows people more time to spend on other more economically constructive activities (rather than travelling distances to fetch water).

Summary Indicators for Future Monitoring

Inland Water and Water Supply Indicators	How we are doing?	Comments
Remaining intact river length in relation to conservation targets	☹ ☹	76% of the western Cape's rivers are critically threatened
Change in ecological status class of rivers and wetlands	?	Currently only baseline data
Exceedances of South African Water Quality Guideline levels of nitrates, phosphates and faecal coliform bacteria	😐	The Gouritz and Breede systems show exceedances, the Berg system not.
Total water available versus water used per annum	☹	Demand is exceeding supply in nearly all the WMA.
Total water used per sector	N/A	The irrigation sector uses the most water in the Western Cape.
Percentage of households with piped potable water to dwellings	☺	67% of the population of the Western Cape has piped water to their dwelling (higher percentage than all other provinces)

Suggested Indicators for Future Monitoring

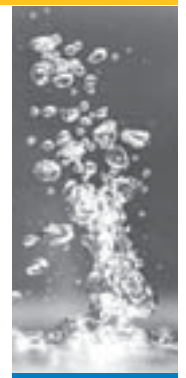
- It is suggested that the River Health Indicators be refined and data for the entire province be compiled.
- It is also suggested that monitoring and data gathering about the status and quality of groundwater be initiated and included in future reports.

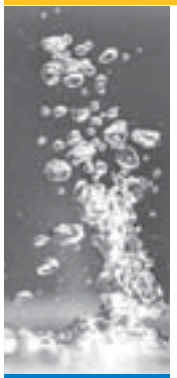
RESPONSES

The table below summarises some of the legislation and other initiatives that have been implemented in response to the inland water and water supply issues discussed:

Internatrional	• NEPAD Water and Sanitation Sector Policy Objectives • RAMSAR Convention • Millennium Declaration and WSSD Targets
National	• Constitution of the Republic of South Africa (Act 108 of 1996) • White Paper on Basic Household Sanitation (2001) • White Paper for Sustainable Coastal Development in South Africa • White Paper on Integrated Pollution and Waste Management for South Africa • National Water Act (Act 36 of 1998) is the principal legal instrument relating to water resources management in South Africa and contains comprehensive provisions for the protection, use, development, conservation, management and control of South Africa's water resources • Water Services Act (Act 108 of 1997) deals with the provision of potable water and sanitation services. It provides a regulatory framework for water services institutions and water services intermediaries, and identifies municipalities as water services authorities that must prepare and each year update a Water Services Development Plan • National Environmental Management Act (Act 107 of 1998) (NEMA). • Conservation of Agriculture Resources Act (Act 43 of 1983) • Environmental Conservation Act (Act 73 of 1989) • National Water Resource Strategy of 2004 established under Chapter 2 of the National Water Act • The 1994 Water Supply and Sanitation Policy is now superseded by the 2003 Strategic Framework for Water Services • Health Act (Act 63 of 1977). All water services providers required to ensure a fluoride concentration of 0.7 mg/l in potable water • SABS Code of Practice 0306: 1998 The Management of Potable Water in Distribution Systems • Control programmes, such as: – Working for Water (invasive alien plant clearing) – Working for Wetlands • Southern African Vision for Water, Life and the Environment in the 21st Century
Provincial	• Water Service Sector Strategy for the Western Cape. • Ukavuka • The Skuifraam Dam is being built as part of the Berg Water Project

Other (local)	• Water Services Development Plan. Each municipality to prepare and each year update a Water Services Development Plan, in terms of the Water Services Act • Institutions Created Under the National Water Act • Catchment Management Agencies (CMA) in each of the Water Management Areas – Water User Associations (WUA) will operate on a restricted local level and are in effect cooperative associations of individual water uses who wish to undertake related water activities for a mutual benefit – Water Tribunal, where appeals against administrative decisions by the Department of Water Affairs and Forestry and CMA's can be heard – Water Services Authorities – municipalities, including district or rural councils that are responsible for ensuring access to water services – Water Services Committees to provide water services to communities within their own service areas, where the Water Services Authorities having jurisdiction in the areas in question are unable to provide water services effectively – Advisory Committees, which may be appointed by the Minister of Water Affairs and Forestry to provide advice on matters falling within the scope of the Act





LINKS

Inland water and water supply links to other chapters, as water is fundamental to economic growth; social development; improvement of quality of life, and to the sustainable use of our natural environment. This chapter has the strongest links to:

Biodiversity – the degradation of freshwater systems, including wetlands, is a critical issue that is resulting in the loss of biodiversity in these ecosystems. The monitoring of inland water can also contribute significantly to the monitoring and thus conservation status of biodiversity as a whole.

Health – no access to potable water increases the risk of disease and poor health.

Waste and Sanitation – insufficient and poorly managed waste facilities result in the pollution of rivers and ground water.

Coastal Zone – Inland water systems affect the coastal zone, particularly estuaries where freshwater flows into the sea. Activities and poor management practices in the water catchments areas affect the coastal zone.

Economics and Poverty and Tourism – Economic development and tourism is dependent on water in a number of ways. With an increase in economic growth there is an increase in water demand, which needs to be managed in a sustainable manner.

Air and climate – sea level rise could possibly lead to salt water intrusions into coastal aquifers.

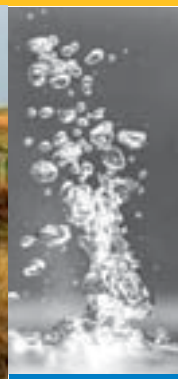
CONCLUSION

Rivers are essential to underpin economic activity and sustain life. In the Western Cape, 76% of rivers are classified as critically threatened. This extremely poor state of the Western Cape's rivers is largely a result of poor land management in river catchments areas.

Access to potable water is considerably better in the Western Cape than in any other province in South Africa. However, the limited water resources available are already under considerable pressure, and demand exceeds availability in five out of six Western Cape Water Management Areas.

Continued downward pressure on real agricultural prices, coupled with consumer resistance to genetically modified crops, is forcing the agriculture sector to improve its efficiency in the use of water. If the industrial sector develops at the expense of agriculture, it should be geared towards low water users (with low effluent discharges), rather than high water users.

The management of freshwater systems and the provision of water to all the citizens of the province will require the integrated management of land and water use. Also, the efficient utilization of available water resources is essential if the expanding urban developments and the agricultural needs of the southern Western Cape are to be satisfied. The region must make the best possible use of the economically exploitable local resources, including re-cycling and reuse of effluent.



NOTES ON DATA

- The results from the assessment of river ecosystem status are only for the main rivers (the longest portion of river passing through a quaternary, or fourth order, catchment) and ignore the contribution that tributaries can make to achieving conservation targets. Results from the River Health Programme will prove to be a useful provincial indicator in the future, once the results for the entire province have been compiled.
- The quality and quantity of groundwater could not be effectively presented in this report due to a lack of data that is available on a provincial level. This represents a significant data gap.