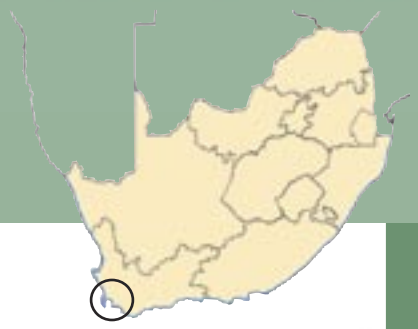
STATE OF RIVERS REPORT

Greater Cape Town's Rivers 2005



River Health Programme

Greater Cape Town's Rivers 2005

SUMMARY

Overall State of Greater Cape Town's Rivers

Generally, only a few of the upper reaches of the rivers in the greater Cape Town area are still in a natural or good ecological state. Development in the lowland areas has modified the rivers, resulting in their poor ecological state. Significant stretches of most rivers have been canalised, have poor water quality, modified flows and abundant alien fish and plant life. The ecological functioning and delivery of goods and services by these rivers have been severely reduced. Many rivers require rehabilitation.

Greater Cape Town's River Catchments

The Steenbras, Sir Lowry's Pass, Lourens*, Eerste/Kuils, Sand, Zeekoe, Silvermine, Else, Schusters, Krom, Bokramspruit, Hout Bay*, Salt, Diep*, Sout, Buffels and Modder rivers are situated within the greater Cape Town area. These rivers rise in the mountain ranges of the Hottentots Holland Mountains in the east and Table Mountain and Cape Peninsula mountains in the south west.

Urban development is the predominant land-use in the low-lying areas, with the Cape Flats being the most densely populated. Other major land-use activities are conservation in the south, irrigated agriculture to the east and dryland agriculture in the north. Small areas of natural vegetation are found throughout these catchments.

The rivers in greater Cape Town have been divided into the following four management areas: Southern; Central; Eastern and Northern. The following pages provide a summary of the present state of the rivers in each of these management areas.

Impacts and Proposed Management Actions

Wastewater Discharges and Runoff

Stormwater and litter from urbanised areas surrounding the Lotus and Diep (Cape Flats), Lourens (Somerset West), Hout Bay (Hout Bay), Bokramspruit (Oceanview), Sir Lowry's Pass (Sir Lowry's Pass Village) and Eerste (Kyamandi) rivers, as well as wastewater discharges and spills from blocked sewage pump stations in the Kuils and Black/Vygekraal rivers have resulted in serious water quality problems. This and other sources of urban pollution pose a risk to human health and result in the loss of pollution-sensitive invertebrates and indigenous fish.


Litter

Management Actions

- Improve monitoring and management of stormwater runoff and wastewater discharges and spills
- Involve communities in initiatives to improve river health (Adopt-a-river or contact your local 'friends' group)

River Health Indices (p. 6)

- Index of Habitat Integrity
- Riparian Vegetation Index
- Fish Index
- South African Scoring System
- Water Quality

River Health Categories (p. 7)

- Natural (N)
- Good (G)
- Fair (F)
- Poor (P)
- Unacceptable (U)

What is River Health?

Healthy rivers provide goods and services (water supply, breakdown of pollutants, conservation, flood attenuation, natural products, recreation and spiritual rituals) which contribute to human welfare and economic growth. When people use rivers, they impact on river health. The National River Health Programme assesses the health of rivers by measuring selected ecological indicator groups that represent the condition of the larger ecosystem. The data are simplified and represented as indices.

* The Diep, Lourens and Hout Bay rivers have been assessed in a previous State of Rivers report. See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003). Information on these rivers has been included in the above summary to provide a complete overview of the state of greater Cape Town's rivers.

River Modification

Many of Cape Town's rivers suffer from habitat loss due to canalisation or the presence of gabions/levees/weirs in the river. Canalisation is most evident in densely populated urban areas surrounding the Black, Elsieskraal and Keysers rivers. The Big and Little Lotus rivers, which are largely artificial, are canalised along most of their reaches.

Stabilisation of the Kuils River

Straightening and deepening of channels also occur as a result of invasive alien plants or from sediment dredging. This has reduced habitat availability for aquatic life. The river's ability to attenuate floods and decompose pollutants is reduced by canalisation, while levees intensify flood flows, disrupt the natural ability of the floodplain to absorb flood water, extend flood damage and increases siltation in the river.

Management Actions

- Restore the natural channel shape and reintroduce meanders in rivers, where possible. Discourage additional canalisation or construction of levees, gabions or weirs
- Introduce indigenous riparian and instream vegetation to rehabilitate the river and improve water quality
- Create habitat diversity (pool and riffle/runs) to provide refuge areas for aquatic life
- Restore substrate diversity (rocks, pebbles, gravel, sand, mud) to increase biotic diversity

Alien Species Infestation

Invasive alien fish are widespread in the lower reaches of nearly all of Cape Town's rivers. These species compete with the indigenous fish for food and habitat and prey on them. This has reduced the numbers and distribution of indigenous fish.

A variety of alien aquatic weeds have invaded many of Cape Town's rivers, particularly the Black, Lotus, Sand and Eerste/Kuils rivers. The removal of riparian indigenous vegetation has led to invasion by alien plants. Alien plants causes a reduction in habitat integrity, reduce runoff and hence river flows, especially during summer.

Management Actions

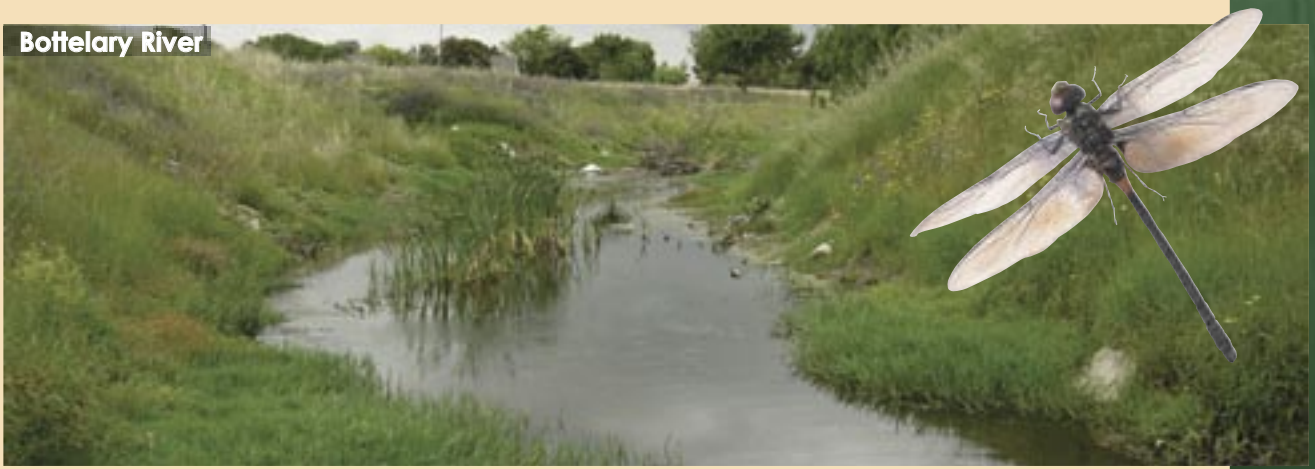
- Clear alien vegetation along and in the rivers and maintain cleared areas
- Maintain green belts/buffers along river corridors and reintroduce indigenous riparian vegetation to act as a buffer between rivers and surrounding areas
- Remove invasive alien fish from rivers
- Support the Integrated Aquatic Weed Control Programme for the removal of nuisance aquatic plants

Flow Modification

A reduction in summer low flows in the Sand, Sir Lowry's Pass and Silvermine rivers occurs as a result of alien invasive plants and water abstraction. Flow in the Kuils River has more than doubled as a result of wastewater discharges, while the flow regime of the Eerste River has been altered by the inter-basin transfer of water from Theewaterskloof/Kleinplaas Dam. The cumulative effect of dams in the catchments are also significant, particularly in the Lourens and Sir Lowry's Pass rivers, and in tributaries of the Diep and Eerste rivers. These modifications to flow have reduced habitat availability for aquatic life.

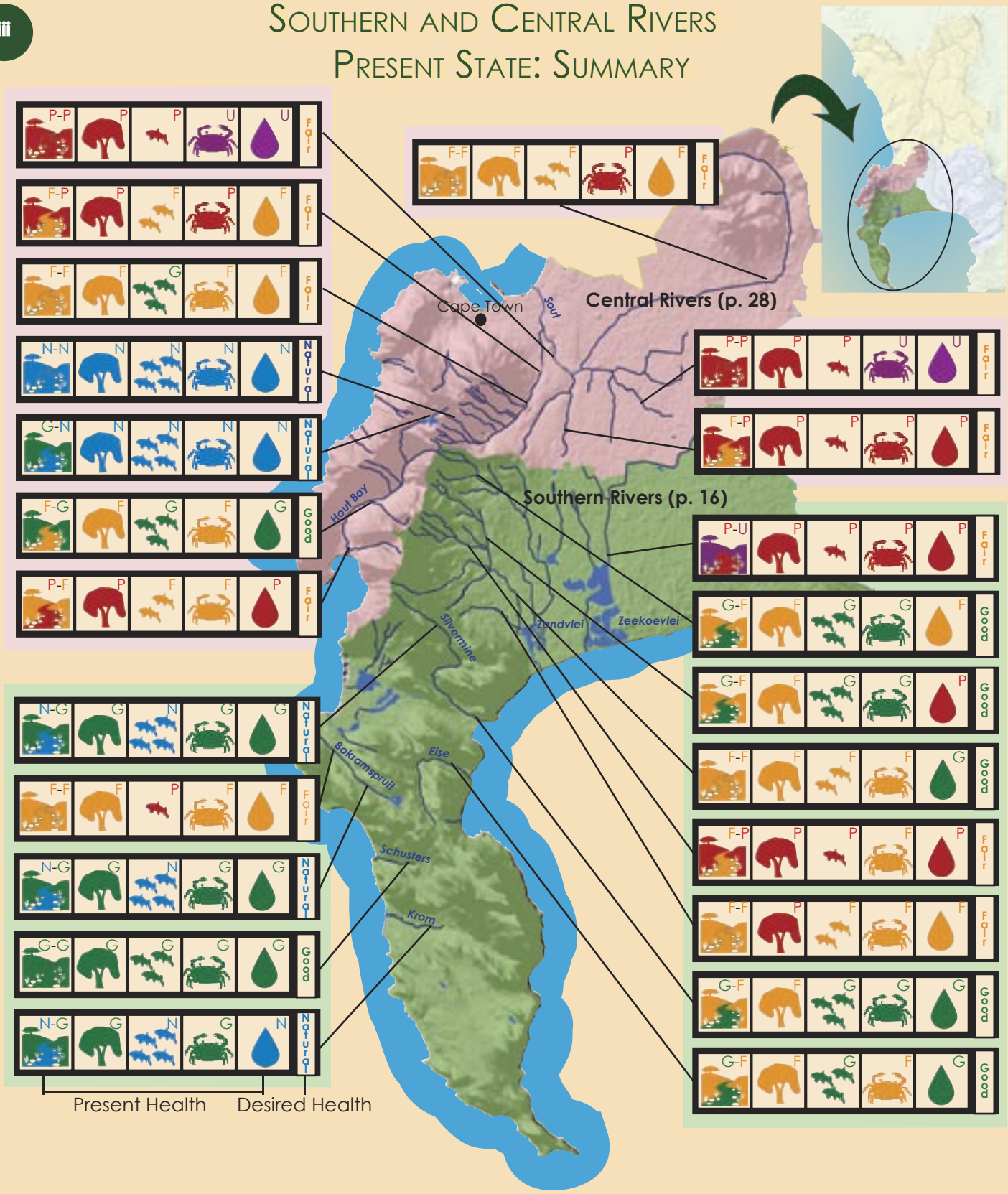
Management Actions

- Monitor and control water abstraction from the Sand and Sir Lowry's Pass rivers
- Discourage new abstractions from Cape Town's rivers in summer - winter water should be stored for use in summer
- Ensure environmental flow releases are made from dams
- Explore ways to reduce the volume of water in the Kuils River (i.e. the reuse of treated wastewater)

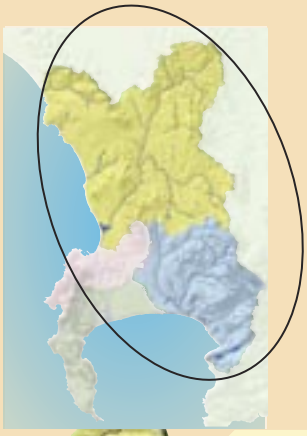


Bottelary River

Southern and Central Rivers
Present State: Summary



Northern and Eastern Rivers
Present State: Summary



Malmesbury

Modder

Buffels

Silverstroom

Sout

Diep

Northern Rivers (p. 32)

Eastern Rivers (p. 22)

Stellenbosch

Eerste

Kuils

Lourens

Sir Lowry's Pass

Steenbras

Somerset West

Present Health

Desired Health

* The assessment of fish, macro-invertebrates and water quality in the Modder and Buffels rivers was not possible as these rivers were dry at the time of the survey

Contributing Organisations

Department of Water Affairs and Forestry

Department of Environmental Affairs and Tourism

Water Research Commission

CapeNature

City of Cape Town

CSIR Environmentek

Norwegian Agency for Development Cooperation

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Foreword

Urban rivers are the most utilized and yet degraded rivers worldwide. Urban development has brought about the degradation of rivers through a deterioration of water quality, increased flooding and a loss of ecological functioning. The rivers of Cape Town are no different. As agriculture developed in the greater Cape Town area, increasing amounts of water were drawn from these rivers and as the area became urbanised, watercourses increasingly served as conduits for stormwater and wastewater. Over the past decades waterbodies within the area have also been canalised to reduce the risk of flooding. Today many Cape Town rivers are impacted as they flow for their entire length over a dense urban landscape towards the ocean. Only the upper reaches in the mountains have been spared these impacts. Cape Town, with its unique indigenous vegetation and breath-taking beauty, has an economy that is entrenched in tourism and is deeply dependent on its rich natural resources. However, social and economic development have also had their impact on the ecological sustainability of the urban rivers.

To sustain the socio-economic goods and services provided by these rivers, the rivers need to be monitored and their current state assessed and reported on according to acknowledged scientific methodologies. Since its introduction into the Western Cape, the National River Health Programme and its characteristic State of Rivers reporting have developed into a brand of its own. These reports are now widely recognized by the public and decision-makers alike for their effectiveness in communicating complicated scientific findings in broadly understandable and clear language. I trust that this report will render impetus and meaning to the conservation, rehabilitation and sustainability of Cape Town's rivers.

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State of Rivers Report: Greater Cape Town's Rivers

Context

The current state of the aquatic ecology presented in this report is based on the findings of river surveys that were conducted in and around greater Cape Town as part of the River Health Programme, Western Cape. These surveys took place during 2004 and 2005.

Contents

Introduction

Healthy Rivers For Healthy People

Life on earth depends on water. In nature, freshwater is not found in taps and buckets, but in rivers, wetlands, estuaries and groundwater. People use water for drinking, cleansing, growing food and for the delivery of other goods and services (recreational, spiritual and aesthetic use).

When people use water, they impact on the water resource and change the number and kinds of plants, animals and habitats occurring naturally, thereby reducing the ecological functioning or "health" of the resource. Urban rivers often have a reduced ecological functioning but are still important for socio-economic purposes. These rivers can still deliver many **goods and services** such as the breakdown or dilution of pollutants, flood control, erosion and silt control. They also play an important role in recreation, particularly for children who live along and play in these rivers.

Where rivers have been severely altered, the concern is not the protection of ecosystem health, but the prevention of waterborne diseases and illnesses (diarrhoea, respiratory ailments, skin irritations) and the maintenance of acceptable aesthetics in and around rivers. Rehabilitation of severely degraded rivers is possible (see p. 44), but can be a lengthy process that often requires significant financial input and commitment.

Water Policy, Legislation & Management

The need for sustainable, equitable and efficient water use is central to South Africa's water resource management policy and legislation. The National Water Act (Act 36 of 1998) is the principle legal instrument for the protection, use, development, conservation, management and control of our water resources.

The National Water Resources Strategy (2004) provides a long term plan of how the Act is to be implemented. A protective approach to water resource management has been adopted where water use activities are allowed according to a desired water resource state. This means that water resources are "looked after and used wisely", not "kept separate and preserved".

Integrated Water Resource Management

Integrated water resource management "promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in a equitable manner without compromising the sustainability of ecosystems" (Global Water Partnership, 2000).

Rivers, wetlands, estuaries and groundwater are all linked within the water cycle. They are also linked to the surrounding land and the human activities that impact on them. To address the inter-related nature of water resources and ensure sustainable, equitable and efficient water use, these water bodies need to be managed in an integrated manner. This means that water availability, quality and use, as well as environmental and socio-economic issues must be taken into account. Co-ordination and co-operation between decision-makers and water users needs to take place at all levels.

Informed decision-making that is critical to integrated water resource management, relies on reliable data and information. The River Health Programme (see p. 4) is one of many monitoring programmes that provides information on the ecological status and trends of water resources.

Catchment Management Agencies

The National Water Act provides for formal structures and processes for integrated water resource management at a catchment and local level, through the establishment of catchment management agencies and a strong user representation. These agencies provide a forum for government authorities and stakeholders to work towards a consensus on the management and development objectives for a catchment, which plays an important role in integrating land-use and water management. Partnerships and community involvement is of utmost importance in maintaining a healthy environment (see p. 47).

What Is The River Health Programme?

The Department of Water Affairs and Forestry, custodian of South Africa's water resources, protects the health of aquatic ecosystems and ensures the sustainable use of water. The River Health Programme, operational since 1994, is a key part of this responsibility.

The River Health Programme assesses the biological and habitat integrity of rivers (through evaluation of, for example, fish, aquatic invertebrates and riparian vegetation). This assessment enables reports on the ecological state of river systems to be produced in an objective and scientifically sound manner. Information from the River Health Programme assists with identification of those areas where unacceptable ecological deterioration is taking place. In addition, this programme reflects the effectiveness of existing river management policies, strategies and actions.

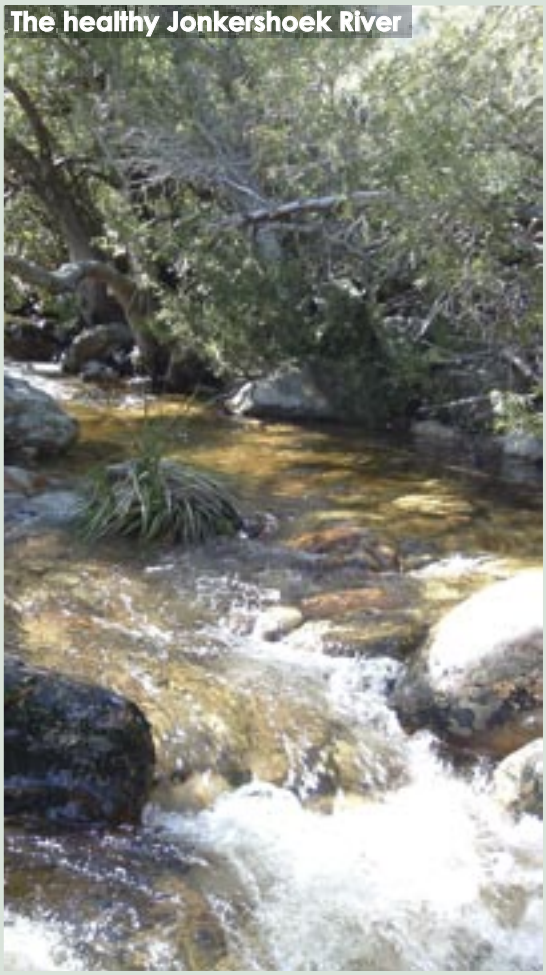
Monitoring aquatic ecosystem health is a requirement in terms of the National Water Act and the results are important for the application of the National Environmental Management Act (1998).

The River Health Programme is a collaborative venture and partnerships are vital for its success. The national organisations leading the River Health Programme are the Department of Water Affairs and Forestry, Department of Environmental Affairs and Tourism and the Water Research Commission. A variety of organisations within each province implement the River Health Programme at a local level.

Why Do We Monitor and Report On River Health?

Healthy rivers provide goods and services that contribute to human welfare and economic growth. Knowledge of the impacts on a river provides insight into why the river is in its present health.

'River health' is the overall condition of the river. The term can be compared to the health of a person or an economy. Rivers are central to our welfare and economic development. Their health is essential to our well-being.



The healthy Jonkershoek River

What Are State of Rivers Reports?

State of Rivers reporting is a spin-off of State of the Environment (SoE) reporting, which has become a recognised form of communication on environmental issues over the past decade. The aim is to provide better information for environmental decision-making. The national SoE uses the Driving Force-Pressure-State-Impact-Response framework to explain what causes environmental change, the wider implication of that change and what we can do to manage the change. State of Rivers reporting uses the same approach, but often with slightly different terminology.

State of Rivers reporting disseminates information on river health to:

- Assist in ecologically sound management of rivers;
- Inform and educate people regarding the condition of our rivers; and
- Encourage wide participation by all stakeholders.

The River Health Programme reports and posters will eventually cover all major river systems in South Africa. These will be updated on a regular basis.

How To Read This Report

This introductory section deals with the overall aims of the River Health Programme. The next few pages provide general information on the methods and the study area, followed by four sections dealing with greater Cape Town's rivers in detail. Each section outlines catchment activities, present and desired health, pressures on the river and key management actions required.

River Health Indices

What Are River Health Indices?

Many physical, chemical and biological factors influence river ecosystem health. The River Health Programme focuses on selected ecological indicator groups that represent the larger ecosystem and are feasible to measure. This report uses river health indices to present data in a format that is easy to understand. The following indices have been used in this report:

Index of Habitat Integrity (IHI)

The availability and diversity of habitats are major determinants of aquatic biota that are present. The IHI assesses the impact of human disturbance on the riparian and instream habitats.

Water Quality

Water quality indicates the suitability of water for aquatic ecosystems. This assessment is based on the total phosphate, total nitrogen, ammonia and dissolved oxygen measured in water samples from each sampling site.

South African Scoring System (SASS)

Aquatic invertebrates (e.g. insects) require specific aquatic habitats and water quality conditions. They are good indicators of recent localised conditions in a river. SASS is a relatively simple index, based on invertebrate families found at a site.

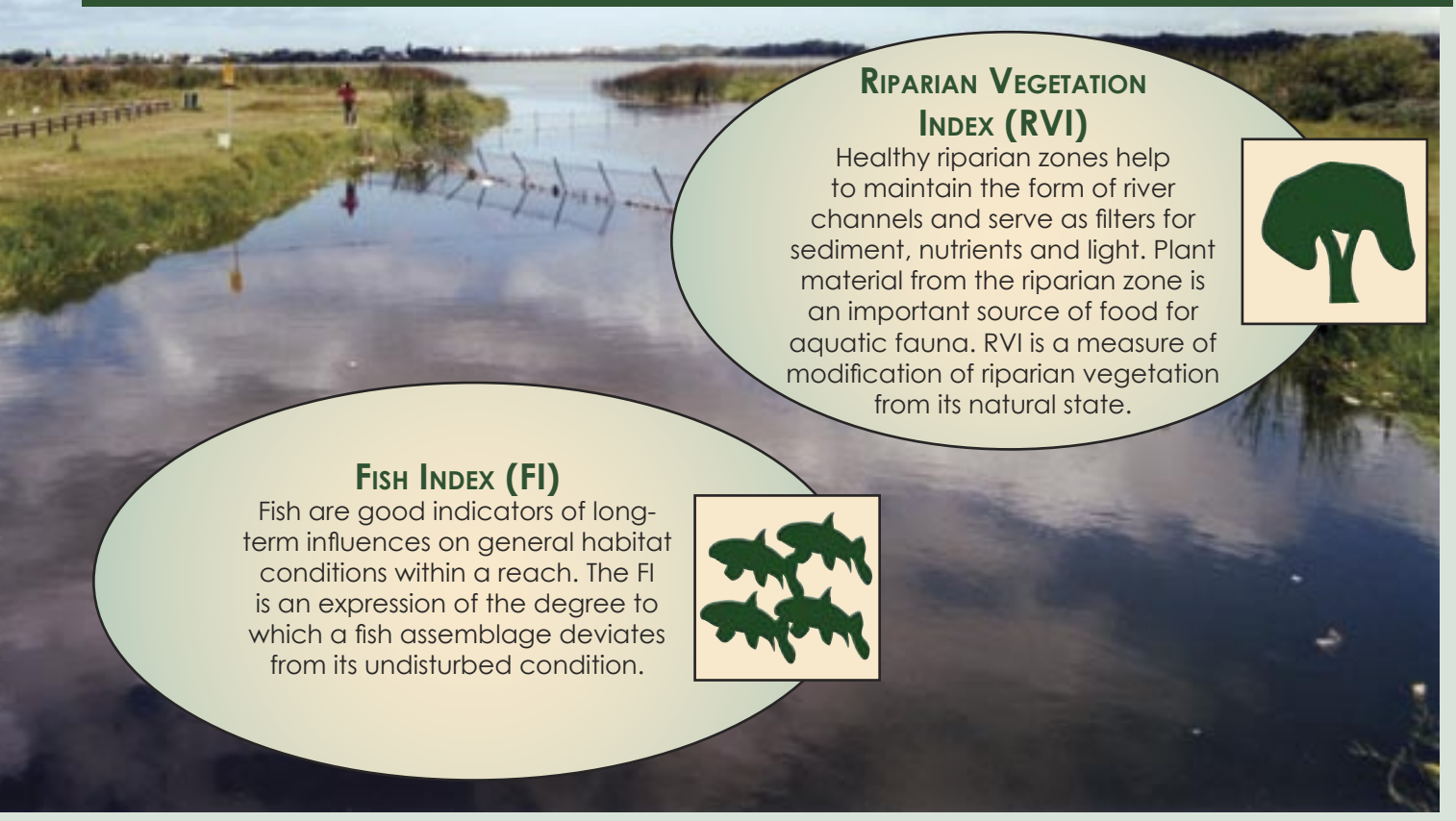
River Health Categories

The **present health** of a river is a measure of the present ecological state of the river during the time of the survey and is presented in terms of the river health categories given below.

The **desired health** of a river is the envisioned future ecological state of the river. It is based on ecological considerations, the need for sustainable development and management actions (rehabilitation) concerning the river environment.

River Health Category	Ecological Perspective	Management Perspective
Natural N	No or negligible modification from natural	Relatively little human impact
Good G	Biodiversity and integrity largely intact	Some human-related disturbance but ecosystems essentially in good state
Fair F	Sensitive species may be lost; tolerant or opportunistic species dominate	Multiple disturbances associated with the need for socio-economic development
Poor P	Mostly tolerant species; alien invasion, disrupted population dynamics; organisms often diseased	High human densities or extensive resource exploitation
Unacceptable* U	Critical modification; almost complete loss of natural habitat & species; severe alien invasion	Very high human density/resource exploitation

*** The "unacceptable" river health category was introduced in this report to reflect the status and trends of degraded urban rivers**



Riparian Vegetation Index (RVI)

Healthy riparian zones help to maintain the form of river channels and serve as filters for sediment, nutrients and light. Plant material from the riparian zone is an important source of food for aquatic fauna. RVI is a measure of modification of riparian vegetation from its natural state.

Fish Index (FI)

Fish are good indicators of long-term influences on general habitat conditions within a reach. The FI is an expression of the degree to which a fish assemblage deviates from its undisturbed condition.

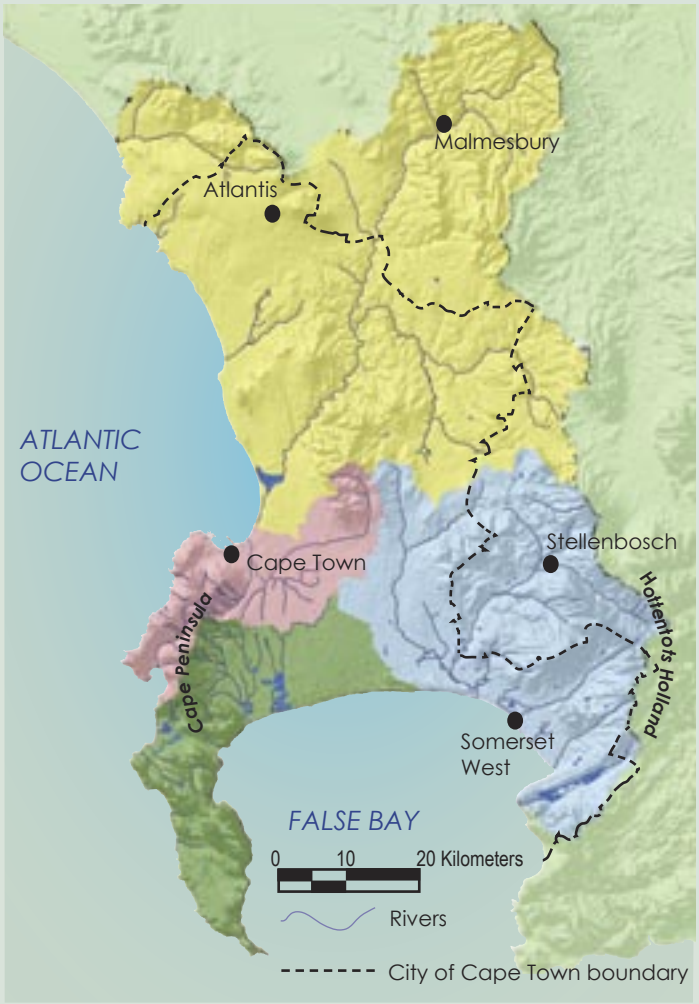
Overview of Greater Cape Town's River Catchments

Major catchments within greater Cape Town are: Steenbras, Sir Lowry's Pass, Lourens*, Eerste/Kuils, Sand, Zeekoe, Silvermine, Hout Bay*, Salt, Diep* and Sout.

Runoff is mostly generated in the mountain ranges of the Hottentots Holland Mountains in the southeast and Table Mountain and Cape Peninsula mountains in the southwest. Sandy lowlands with minimal runoff and a high water-table extend over the central area. Rainfall occurs mainly in winter and is highly varied from over 2000 mm per year in the mountains to less than 300 mm per year along the south west coast.

Cape Town lies within the Cape Floral Kingdom, one of the world's six floral kingdoms. Most of the indigenous vegetation has, however, been replaced by development, with remnants existing on high lying areas where steep slopes limit development.

Of particular importance is the Table Mountain National Park (see p. 29). Nowhere else in the world does an area of such spectacular beauty and rich biodiversity exist almost entirely within a metropolitan area.



Catchment characteristics in the four management areas (these areas co-incide with the City of Cape Town's four management areas but have been expanded in the northern and eastern areas to include river catchments of greater Cape Town):

Management Area	Southern	Eastern	Central	Northern
River & main tributaries	Sand (Diep, Keysers, Westlake), Zeekoe (Big Lotus, Little Lotus), Silvermine, Else, Krom, Schusters, Bokramspruit	Steenbras, Sir Lowry's Pass, Lourens, Eerste,Kuils, Bottelary, Jonkershoek, Blaauwklippen, Bonte, Kromme, Plankenbrug	Hout Bay, Liesbeek, Black, Kromboom, Vygekraal, Elsieskraal, Salt	Diep, Mosselbank, Riebeek, Sout, Silverstroom, Buffels, Modder
Catchment size (km^2)	471	588	327	1087
Geology	Table Mountain Group (quartzitic sandstones), Cape Granite and sandy sediments	Table Mountain Group (quartzitic sandstone), Cape Granite, Malmesbury Group (shale) and sandy sediments	Table Mountain Group (quartzitic sandstone), Cape Granite, Malmesbury Group (shale) and sandy sediments	Malmesbury Group (shale), Cape Granite, Klipheuwel Group (conglomerates) and sandy sediments
Vegetation	Fynbos (Sandstone, Sand and Granite) and Strandveld (Dune)	Fynbos (Sandstone, Granite and Shale) and Renosterveld (Shale and Alluvium)	Fynbos (Sandstone, Sand and Granite), Renosterveld (Shale) and Strandveld (Dune)	Fynbos (Sand), Renosterveld (Shale and Granite) and Strandveld (Dune)
Mean Annual Precipitation (mm)	711	907	764	475
Mean Annual Evaporation (mm)	1400	1421	1400	1477
Mean Annual Runoff (million cubic metres)	73	245	56	114

* The Diep, Lourens and Hout Bay rivers have been assessed in a previous State of Rivers report. See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003)

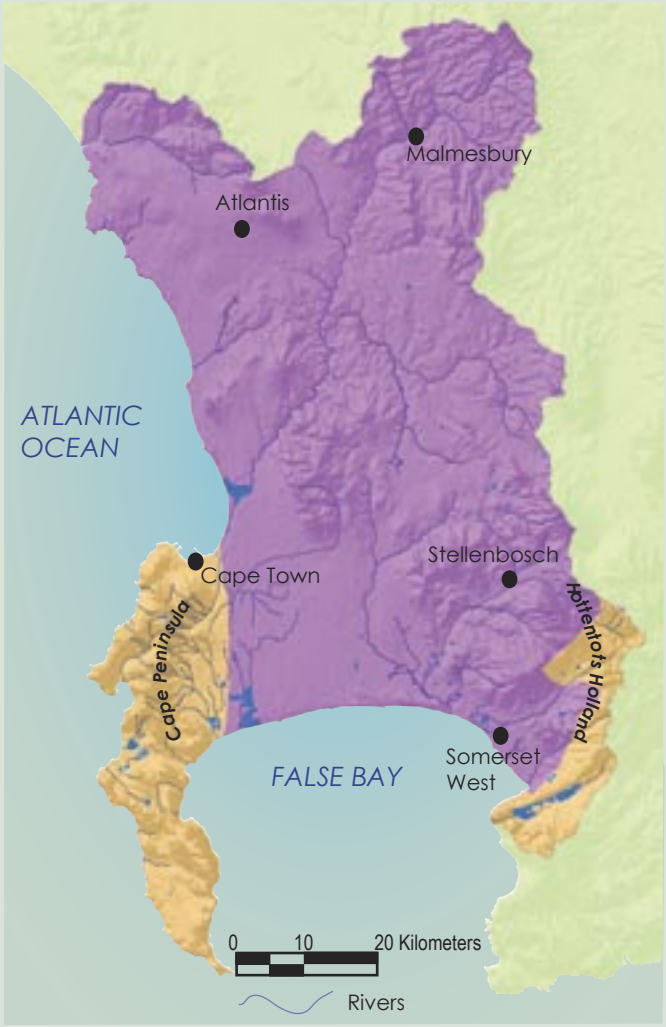
Areas of similar ecological characteristics (e.g. climate, geology and vegetation) are grouped together in ecoregions. Ecological characteristics are important in influencing the distribution and different types of fauna and flora.

ECOREGIONS

The ecoregions in greater Cape Town's river catchments are the South Western Coastal Belt and the Southern Folded Mountains.

South Western Coastal Belt

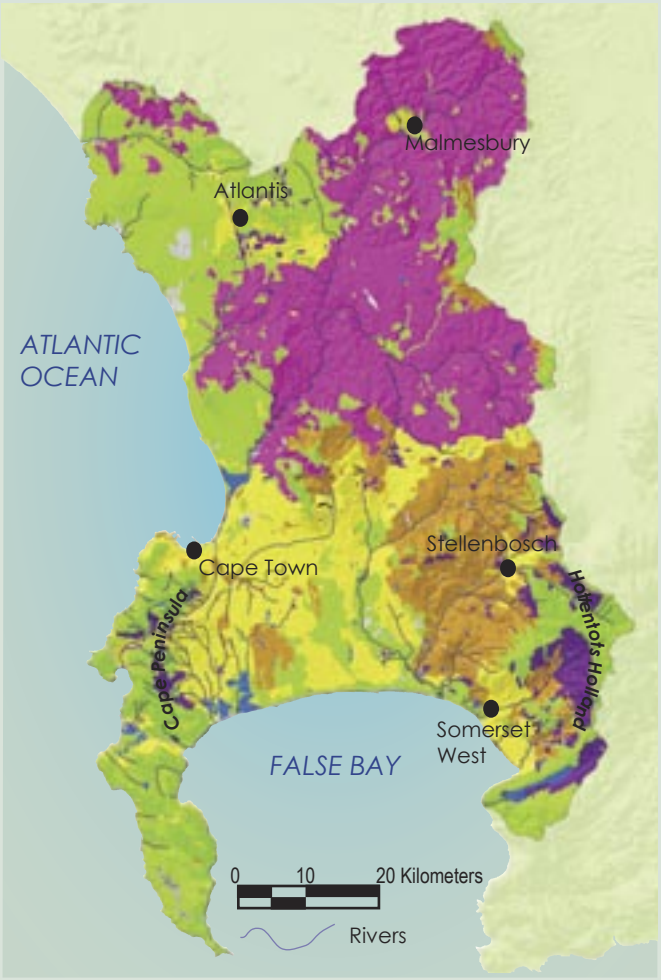
Southern Folded Mountains



Ecoregion	South Western Coastal Belt	Southern Folded Mountains
Landscape	Moderate relief plains	Moderate/high relief mountains and closed hills
Vegetation	Renosterveld (Shale and Granite), Fynbos (Sand and Granite) and Standveld (Dune)	Fynbos (Sandstone and Shale)
Altitude (m)	1 - 300	300 - 1900
Rainfall pattern	Winter	Very late summer to winter, to all year
Mean Annual Precipitation (mm)	100 - 1000	200 - 1500
Mean Annual Runoff (mm)	between 20 and 250	less than 5 to more than 250
Average Daily Temperature (°C)	14 - 20	10 - 20
Geology	Shale, sand and biotite granite	Shale, tillite, sandstone and quartzitic sandstone
Soils	Sand-clay, sand-clay-loam, loam-sand, clay-loam and sand-loam	Sand-clay-loam, clay-loam, sand-loam and sand-clay

LAND-USE

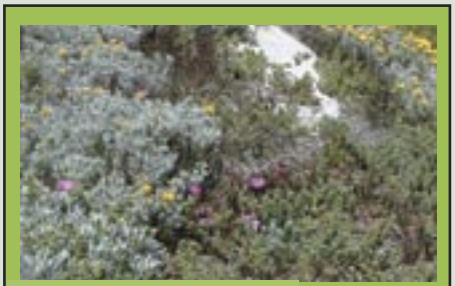
LAND-USE within greater Cape Town consists of urban and peri-urban areas, industry, farming (vineyards, fruit, wheat, livestock), forestry and nature conservation. Residential areas vary in density. The City of Cape Town strives to reduce informal settlements and improve services as this has a direct influence on the quality of life of Capetonians and the health of the environment.

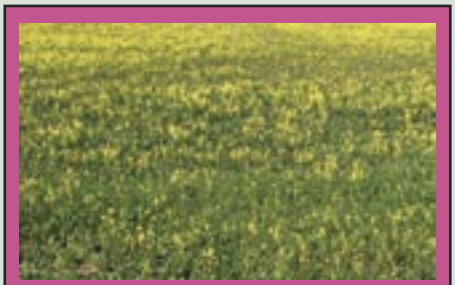



Urban areas (17%)


Irrigated crops (13%)


Forest plantations (4%)


Natural vegetation (33%)


Dryland crops (29%)

Management Area	Southern	Eastern	Central	Northern
Main land-use	Urban, conservation	Agriculture, conservation, natural vegetation	Urban, conservation	Agriculture
Population (2001)	774 288	924 117	893 093	301 901
Informal houses (2003)	36 958	37 707	12 561	5207

In Cape Town, approximately 96 % of the population have access to at least a basic level of water supply (a dwelling within 200 m of a tap or a maximum of 25 dwellings to one tap) and 91 % have at least a basic level of sanitation service (normally one toilet per five dwellings). A once weekly door-to-door service for collection of solid waste is carried out for 94 % of the City's population. In Stellenbosch, approximately 97 % of the population have at least a basic level of water supply and 93 % have at least a basic level of sanitation services.

Population

The total population in greater Cape Town in 2001 was approximately 3.2 million, with the highest density occurring on the Cape Flats. The average population growth rate in 2001 was about 3 % per annum. The impact of HIV/AIDS and tuberculosis is expected to reduce this growth rate to 1.2 % by 2010.

Annually, approximately 35 000 people migrate to Cape Town, with the majority (47 %) originating from the Eastern Cape. As a result, informal settlements are continually expanding. So-called 'backyard dwellings' (without services) on formally developed and serviced properties impact on quality of life and the environment. The City of Cape Town is accelerating the delivery of new housing developments (N2 Gateway) with associated infrastructure (water supply and sanitation).

Informal settlements along Kuils River

Economic Profile

Cape Town has a strong and diverse economy dominated by industry (textile and clothing, metal and steel, petroleum, glass) and other activities (real estate, construction). This economy is strongly linked with tourism and agriculture (vineyards, fruit and wheat) in the surrounding areas. Cape Town is one of the top ten international tourist destinations, with tourism being one of the most important economic activities for future development of the Western Cape. It provides more than 75 000 jobs, with over a million foreign tourists visiting the Western Cape annually.

The gross domestic product (GDP) for Cape Town in 2003 was R125 billion in economic goods and services. Cape Town contributes 12.4 % towards the national GDP and 74.7 % of the provincial GDP. The economic growth rate for 2000 was 2.6 %. Future land-use analyses indicate that residential land will increase by 25 % and business/commercial land by 125 %.

Approximately 22 % of the economically active population are unemployed, with the majority residing on the Cape Flats. Local government initiatives to empower the unemployed and alleviate poverty include skills training and providing employment in a variety of Expanded Public Works Programme projects such as the Working for Water and Working for Wetlands programmes.

New development along the Elsieskraal River

Water Use

Greater Cape Town's Water Situation


Water supply in informal areas

Current water demand already exceeds the water yield available for greater Cape Town. This is exacerbated by recent below average rainfall years. Construction of the Berg River Dam[#] (81 million cubic metres or 18 % additional water) to augment water supplies and a number of water conservation and demand management actions (a saving of 20 % on projected consumption) have been initiated. In addition, the following alternative water supply options are being considered:

- Groundwater from the Table Mountain Group, Cape Flats and Newlands aquifers (see p. 13);
- Treated wastewater re-use (industrial and agricultural; reclamation for domestic use);
- Further development of the Eerste and Lourens rivers; and
- Desalination of seawater.

Most of greater Cape Town's water is supplied from dams (98 %) and only 15 % of this supply is obtained within the metropolitan area.

Greater Cape Town Water Sources	Water yield (Mm^3/a)*	% of total yield
Theewaterskloof/Kleinplaas	291	43
Voëlvlei	105	20
Wemmershoek	54	15
Palmiet	22.5	7
Upper/lower Steenbras	40	11
Simon's Town: Lewis Gay/Kleinplaas	1.8	0.4
Lourens River: Land-en-Zeezicht	2.7	0.6
Table Mountain: Hely-Hutchinson, Woodhead, De Villiers, Victoria, Alexandra	4	1.2
Atlantis aquifer	4.4	1.5
Albion spring	1	0.3

*million cubic metres per annum

Currently, water restrictions are being imposed as a means of reconciling Cape Town's water demand with the available water supply. Capetonians are increasingly seeking to supplement their water supply from boreholes, wells and rivers. The City of Cape Town has established a call-centre service (Water line 086 010 3054) to respond to queries from the public.

Climatologists predict that the Western Cape's devastating drought is likely to become a recurring event as global warming makes the region progressively drier. Rain-bearing winter cold fronts are predicted to pass to the south of the continent, resulting much fewer winter rainfall events. The current water situation in Cape Town is likely to continue well into the 21st century. This will have serious implications for the ecological state of aquatic ecosystems and for all who depend on the resource.


Water abstraction

[#] See State-of-Rivers report: Berg River System (2004)

Borehole drilling rig

GROUNDWATER

Newlands, Atlantis and the Cape Flats aquifers provide groundwater to greater Cape Town for the following uses:

Aquifer	Annual yield (Mm^3)*	Use
Newlands	3.6	Industrial (SA Breweries), sportsfield irrigation
Atlantis	5.5	Atlantis bulk water supply
Cape Flats	Variable with *ad hoc* abstraction	Horticulture, small-scale use

*million cubic metres

The sandy substrate of the Cape Flats and Atlantis areas has a low filtering efficiency and, as groundwater is recharged by slow seepage from the surface, this water resource is particularly vulnerable to pollution from human activities (e.g. leachate from landfill sites). The water quality in the Newlands Aquifer is relatively good and uncontaminated.

TABLE MOUNTAIN GROUP AQUIFER

The Table Mountain Group (TMG) aquifer is a unique regional aquifer that is part of the Table Mountain Group formation, extending over 900 km from Nieuwoudtville to Cape Agulhas and then eastwards to Algoa Bay.

The aquifer has been identified as a potentially significant source of future water supplies to the Western and Eastern Cape. Research on flow and boundary conditions, yield potential, groundwater/surface water interaction, community water supply needs and water volumes required to sustain sensitive ecosystems was initiated in 2000 to investigate the possiblities for sustainable use of the TMG aquifer.

Hydrogeologists have estimated that the TMG aquifer has a groundwater volume of "tens of billions" of cubic metres. Geothermal evidence from hot springs indicates that groundwater circulation can occur up to depths of 2000 m. Groundwater quality in the mountainous regions of the TMG aquifer is characterised as being amongst the purest in South Africa, although the acidity of the water can be highly corrosive and aggressive to water supply infrastructure.

Over 30 major users of the TMG aquifer have been identified, ranging from municipalities to agriculture. These users have major direct and indirect impacts on the hydrogeology of the Western and Eastern Cape. Borehole yields of up to 120 litres per second and hot-spring flows of 127 litres per second have been recorded.

However, there is great concern about the effect that this demand is likely to have on aquifer-dependent ecosystems such as seeps and rivers, and the potential impacts thereof will need to be established and mitigated.

Wastewater Management

Every local authority has some form of sewage and waste management system and should have the by-laws and regulations to manage these. Water, sewage and waste infrastructure, as well as environmental and health services, are expensive and need to be adequately budgeted for to accomodate regular maintenance and upgrading thereof. Serious health and financial implications are associated with inadequate water and sanitation services. For instance:

- Approximately 15 diarrhoea-related deaths per 1000 people occur in areas where water supply and sanitation services are below standard. Most deaths are children under the age of 5 years old. Nationally, the health cost per diarrhoea case is more than R180.
- In 2000, the cost of poor water quality was R2.2 billion in direct health costs, R0.7 billion in indirect health costs and R64 million for water treatment costs. Environmental and social costs were not included.

The City of Cape Town monitors pollution that affects its water resources. During 2004, the following pollution incidents were recorded:

- 169 illegal discharges to stormwater were inspected and dealt with;
- 78 888 sewage blockages (6 were serious and resulted in overflows into the stormwater system); and
- 43 pump station and rising sewer incidents, mostly as a result of electrical and mechanical problems.

The major non-point source of pollution in Cape Town is runoff from informal settlements, where adequate sanitation services are still to be provided.

Litter

Stormwater discharge

Wastewater treatment works

Canalisation of Rivers

Many of greater Cape Town's rivers suffer from habitat loss due to canalisation. Extensive canalisation of the Cape Flats rivers (Big and Little Lotus rivers) has occurred as many of these systems were not rivers at all, but rather seasonal wetlands. Urbanisation and encroachment onto these areas necessitated extensive flood alleviation works. This is also the reason for the poor water quality in these 'rivers' as their gradient is insufficient to "flush" the systems, other than at high flows. The following table shows the extent of canalisation:

River	Approximate percentage of canalised river
Sir Lowry's Pass	10
Eerste	10
Kuils	10
Bottelary	5
Black	55
Kromboom	85
Elsieskraal	65
Vygekraal	50
Liesbeek	40
Diep/Sand	75
Lotus	95


Canalised section of the Kuils River

Urban Renewal and Rehabilitation of Rivers

The following projects are being undertaken by the City of Cape Town to improve the state of the rivers:

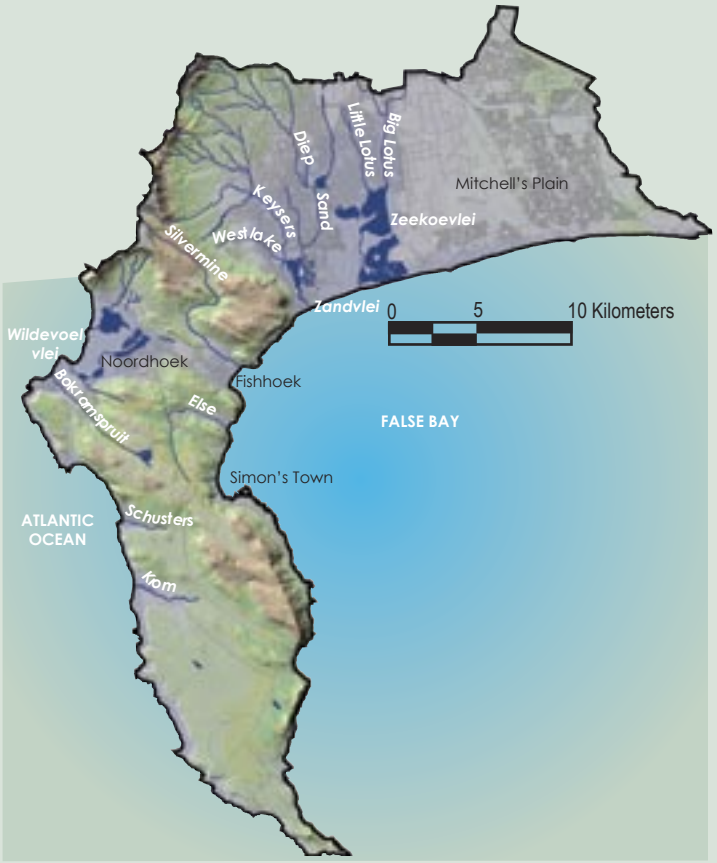
- Lotus River Canal Upgrade;
- Keysers River Restoration Project;
- Liesbeek River Maintenance Project; and
- Elsieskraal River Partnership.

Details on how you can become involved in these projects are provided on page 47.


Keysers River

Southern Rivers

Major rivers in the Southern Management Area of the City of Cape Town are the Sand, Zeekoe (Big and Little Lotus), Silvermine, Else, Krom, Schusters and Bokramspruit. The area forms the south-western part of the Cape Metropolitan Area. Land-use in the north is predominantly residential changing to conservation (Table Mountain National Park, see p. 29) in the south. Urban areas are the southern suburbs and parts of the Cape Flats. There is some horticulture (vegetables) and light industry on the Cape Flats.



The rivers are characteristically short, draining the steep slopes of the Cape Peninsula Mountains before flowing over the flat coastal area and draining into False Bay. The Bokramspruit, Krom and Schusters rivers drain into the Atlantic Ocean.

The Big and Little Lotus rivers flow through the densely populated areas of the Cape Flats and are mostly canalised. Zeekoevlei, Princessvlei and Rondevlei form part of this river system and are important for flood attenuation, recreation and conservation. Downstream of Zeekoevlei, the Cape Flats Wastewater Treatment Works discharges treated wastewater into False Bay.

Other important water bodies in the Southern Management Area are the Zandvlei estuary at the mouth of the Sand River system and the Wildevoëlvlei wetland (see p. 17) at Noordhoek. Zandvlei estuary has benefited from the artificial opening of its mouth. When the mouth is open, saline water flows into the estuary, ensuring that the system is able to function and remain healthy. The manipulation of the mouth requires communication with recreational water users. Residents actively participate in the estuary's management by monitoring salinity at several locations on a weekly basis.

Kleinplaas and Lewis Gay dams, above Simon's Town, have a combined yield of 1.85 million cubic metres per year. These dams are owned by the City of Cape Town and supply water to Simon's Town. The dam (0.1 million cubic metres) in Silvermine Nature Reserve, previously used for irrigation, is no longer in use.

Lotus wetlands

Silvermine Wetland

The Silvermine River is relatively pristine and originates in the Table Mountain National Park. The lower river, originally an unconfined vlei area, was modified in the 19th century when the road and rail bridges leading to Fish Hoek were constructed. Until recently, when flood control measures were taken, this lower reach posed a flooding problem to Fish Hoek. A functioning wetland with a diversity of habitats was created. The City of Cape Town and SANParks have commenced a reed control project in the lower reaches of the river.

Silvermine Wetland

Edith Stephens Wetland Park

Edith Stevens Wetland Park

This wetland park, in the Zeekoe/Lotus catchment, provides four important goods and services:

- Conservation of endemic fern, *Isoetes capensis;*
- Stormwater detention;
- Provision of bird habitat; and
- Environmental education.

Water quality in the wetland is reduced by stormwater runoff from the Big Lotus River and runoff from the Phillipi Horticultural Area.

Wildevoëlvlei Wetland

Wildevoëlvlei Wetland

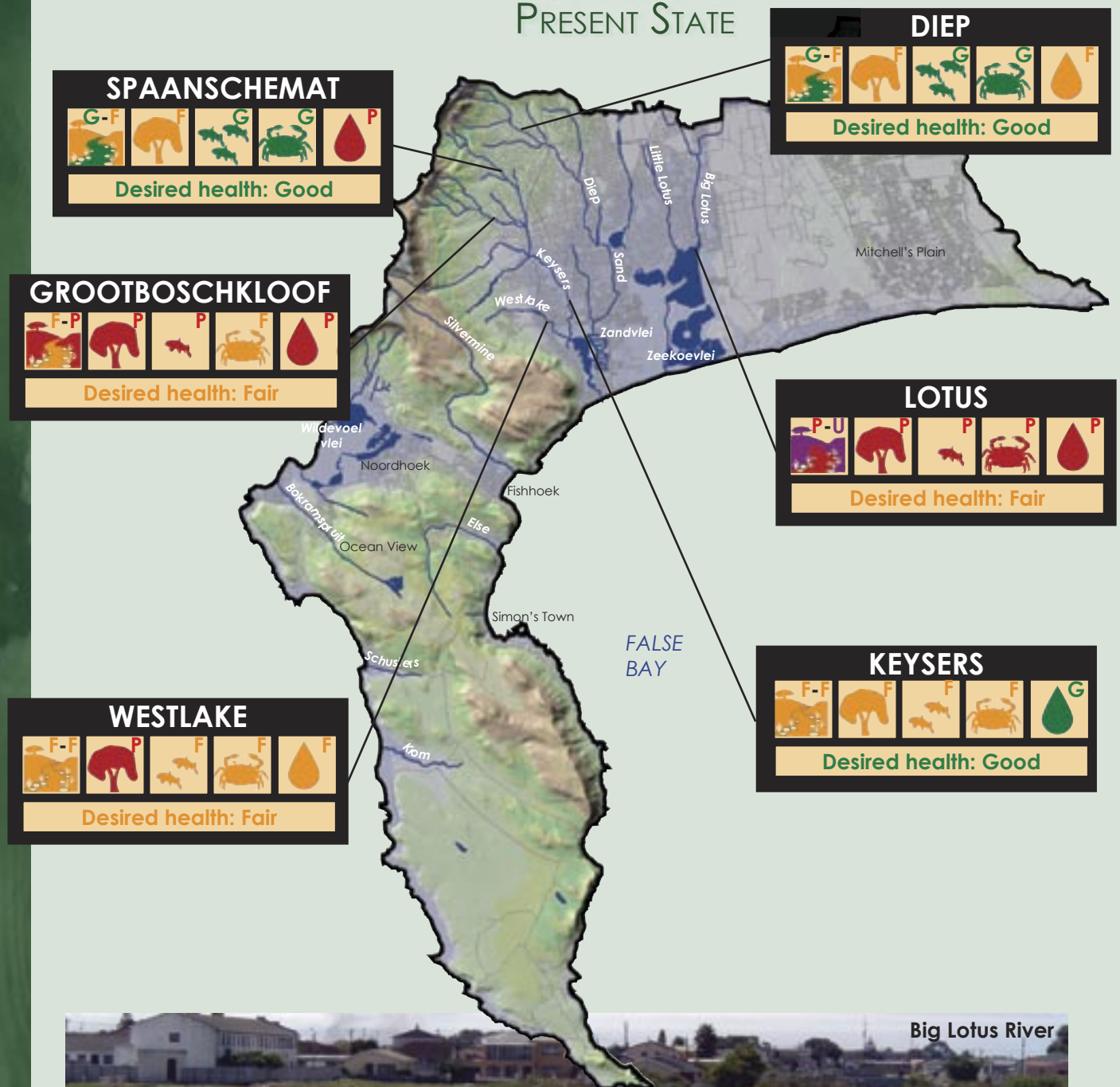
Wildevoëlvlei provides an important refuge area for a variety of palearctic and non-migratory waders (little stint, curlew sandpiper)and wetland-dwelling birds (purple gallinules, ducks and herons) during winter. The wetland is under threat from urban and industrial runoff. In addition, the Wildevoëlvlei Wastewater Treatment Works discharges 6 000 cubic metres of treated wastewater into the wetland per day. This stabilises water levels within the wetland and reduces the feeding habitat of waders. Ducks, geese and coot are now replacing waders.

Goods and Services (see p. 2)

- Conservation in the Table Mountain National Park
- Ecotourism and recreation: bird watching, hiking, picnicing, fishing and water sports
- Religious ceremonies in Princessvlei
- Water supply: bulk water to Simon's Town, vineyard irrigation in Constantia, horticulture in Phillipi, schoolground/golfcourse irrigation and garden watering
- Flood attenuation (e.g. Rondevlei, Princessvlei and Zeekoevlei)
- Breakdown and dilution of pollutants

Southern Rivers (Sand and Zeekoe)

Present State



Big Lotus River

Major Impacts

Urban and Agricultural Development

Stormwater and litter from densely urbanised areas of the Lotus and lower Diep river catchments impact on river water quality. Horticulture (fertilisation of vegetables) in the Lotus River catchment causes high levels of phosphates and nitrates in the river. Vineyards in Constantia impact on flow and water quality in rivers draining into Zandvlei. In these rivers, poor water quality and reduced flows in summer result in disappearance of pollution-sensitive invertebrates and the rivers becoming a health hazard.

Alien Flora

Alien invasive herbaceous plants (nasturtium, kikuyu and wild ginger) have escaped from private gardens and dominate river banks, reducing the suitability and diversity of riparian habitat for aquatic life. Alien trees (poplars and river gum) contribute to the instability of the river banks and have the potential to block the river during heavy rainfall events. Alien aquatic weeds (water hyacinth, parrots feather, water lettuce, red water fern, Kariba weed) have invaded many streams.

Alien Fish

Banded tilapia and mosquitofish are widespread in the lower reaches of the rivers flowing into Zandvlei and compete with the indigenous fish (Cape galaxias) for food and habitat.

River Modification

Modification of the river channel due to development has resulted in the straightening and deepening of channels and reduced habitat quality and diversity.

Water Abstraction

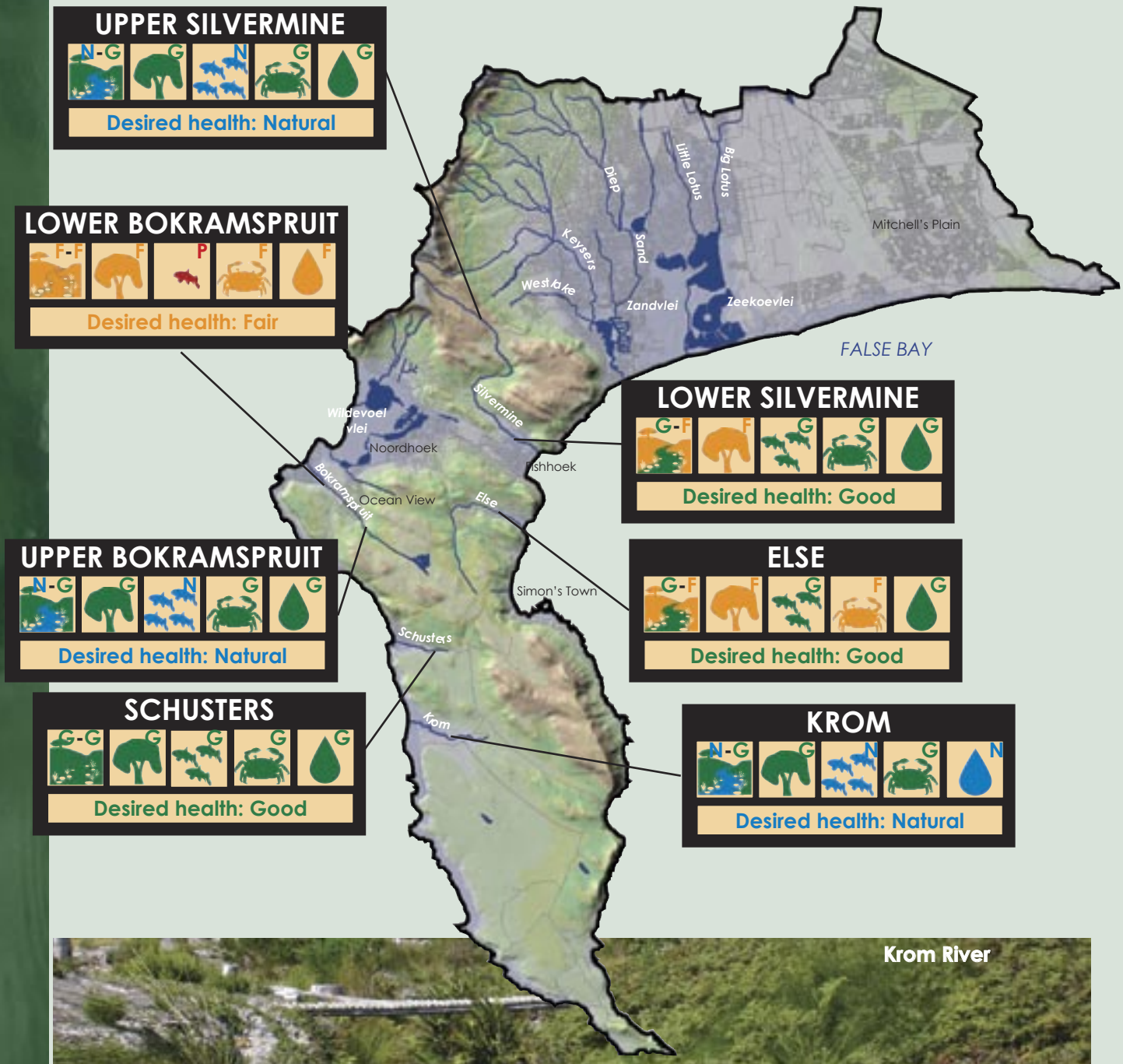
Water abstraction for private gardens reduces the low flows in summer, further reducing water quality and availability of habitat for aquatic life. Lack of environmental flow releases from Pollsmoor Dam has largely modified the habitat and flow in the lower Westlake River, with an increased loss of biota and goods and services.

Management Actions

- Remove alien plants along urbanised rivers and maintain cleared areas
- Re-introduce indigenous riparian vegetation particularly along the Sand River, to act as a buffer between the river and surrounding areas
- Maintain green belts along river corridors in the southern suburbs and parts of the Cape Flats
- Improve monitoring and management of runoff from urban and agricultural (Philippi) areas
- Ensure environmental flow releases are made from Pollsmoor Dam and farm dams
- Involve communities in initiatives to improve river health (adopt-a-river or contact your local 'friends' group, see p. 47)
- Create habitat (pools, runs) and substrate diversity (sand, stones and mud) in these rivers to provide refuge areas for Cape galaxias
- Implement water abstraction control measures on the Sand River system and discourage abstractions during summer

Little Lotus River

Southern Rivers (Peninsula Rivers) Present State



Krom River

Major Impacts

Alien Flora

Indigenous riparian vegetation in the middle reaches of the Bokramspruit River has mostly been replaced by river gum and wattle, while the upper Else and Schusters rivers are dominated by poplars and kikuyu.

Although alien vegetation clearing has taken place in the middle reaches of the Silvermine River, garden escapees pose a threat to its habitat diversity, the recovery of indigenous vegetation and aquatic life.

Alien Fish

Banded tilapia have reduced the number of Cape galaxias in the lower Silvermine River.

Urban and Peri-urban Development

Urban and peri-urban development in the Lower Silvermine, Else, Upper Schusters and Bokramspruit rivers have resulted in moderately high nutrient levels (ammonia and phosphates), which has reduced habitat integrity. This has resulted in changes to the aquatic invertebrate communities and the goods and services (conservation) that the river provides.

Flow Modification

Water supply dams in the upper Else and Bokramspruit catchments have reduced the flow in the lower reaches of these rivers. The Brooklands Water Treatment Plant in the upper Else catchment periodically releases water treatment residue, which flows down the river. This reduces water quality in the Else River.

A series of small instream dams on the upper reaches of the Schusters River has reduced summer flow downstream.

River gum in the Bokramspruit catchment

Management Actions

- Continue alien vegetation clearing initiatives in conservation areas and maintain cleared areas
- Manage stormwater runoff and litter in Ocean View
- Involve communities along the Else, Schusters and Bokramspruit rivers in initiatives to improve river health (see similar initiatives on p. 47)
- Encourage appropriate recreational use of rivers
- Remove banded tilapia in the lower Silvermine River
- Remove alien vegetation (poplar) from the Else River catchment as this area offers good rehabilitation potential

Eastern Rivers

The Steenbras, Sir Lowry's Pass, Lourens* and Eerste/Kuils rivers are major rivers in the Eastern Management Area. These rivers rise in the Hottentots Holland and Stellenbosch mountains and flow southward over a progressively flatter terrain to False Bay.

Land-use is mostly a combination of natural areas and agriculture (vineyards) in the upper reaches of these rivers. Residential areas are Gordon's Bay, Strand, Somerset West, Macassar, Stellenbosch, Kuils River, Eerste River, Bellville, Eversdal and Durbanville. Informal settlements are Khayelitsha, Kyamandi, Nomzamo, Lwandle and Sir Lowry's Village.

Water supply for domestic and irrigation use in this area is largely imported from the Palmiet and Breede/Riviersonderend rivers (see p. 23). A number of wastewater treatment works discharge into rivers in this area (see table).

Pine plantations around Steenbras Dam are being cleared and managed as part of the City of Cape Town's management of its catchment areas. Clearing of alien vegetation in the upper Sir Lowry's Pass River at Wedderwill Estate has resulted in significant recovery of indigenous fynbos.

Wastewater treatment works	Volume (Mcm/a)*	River receiving wastewater
Scottsdene	2	Bottelary
Macassar	13.3	Eerste
Bellville	14.7	Kuils
Zandvliet	16.8	Kuils
Stellenbosch	8.4	Eerste
Gordon's Bay	1.3	Sir Lowry's Pass

*million cubic metres per annum

Plankenbrug Catchment

* See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Lourens River.

Water Supply Schemes To The Eastern Management Area

Water is transferred from the Palmiet Pumped Storage Scheme via Rockview Dam to the Upper and Lower Steenbras dams on the Steenbras River. The Steenbras dams have a combined yield of approximately 40 million cubic metres per annum and are owned and operated by the City of Cape Town.

The Berg-Riviersonderend Scheme transfers water from Theewaterskloof Dam in the Breede River to Kleinplaas Dam at Jonkershoek. This water is for domestic use (3 million cubic metres per year) in Cape Town and Stellenbosch and for irrigation (24 million cubic metres per year) in this management area. Kleinplaas Dam (0.38 million cubic metres per year) serves as a balancing dam to the Franschhoek/Jonkershoek Tunnel system. Two off-channel dams (5.5 million cubic metres per year) in Idas Valley store excess winter water from the Eerste and Dwars rivers to supplement bulk water supply to Stellenbosch.

Upper Steenbras Dam

Kleinplaas Dam

Eerste Estuary

Pelicans

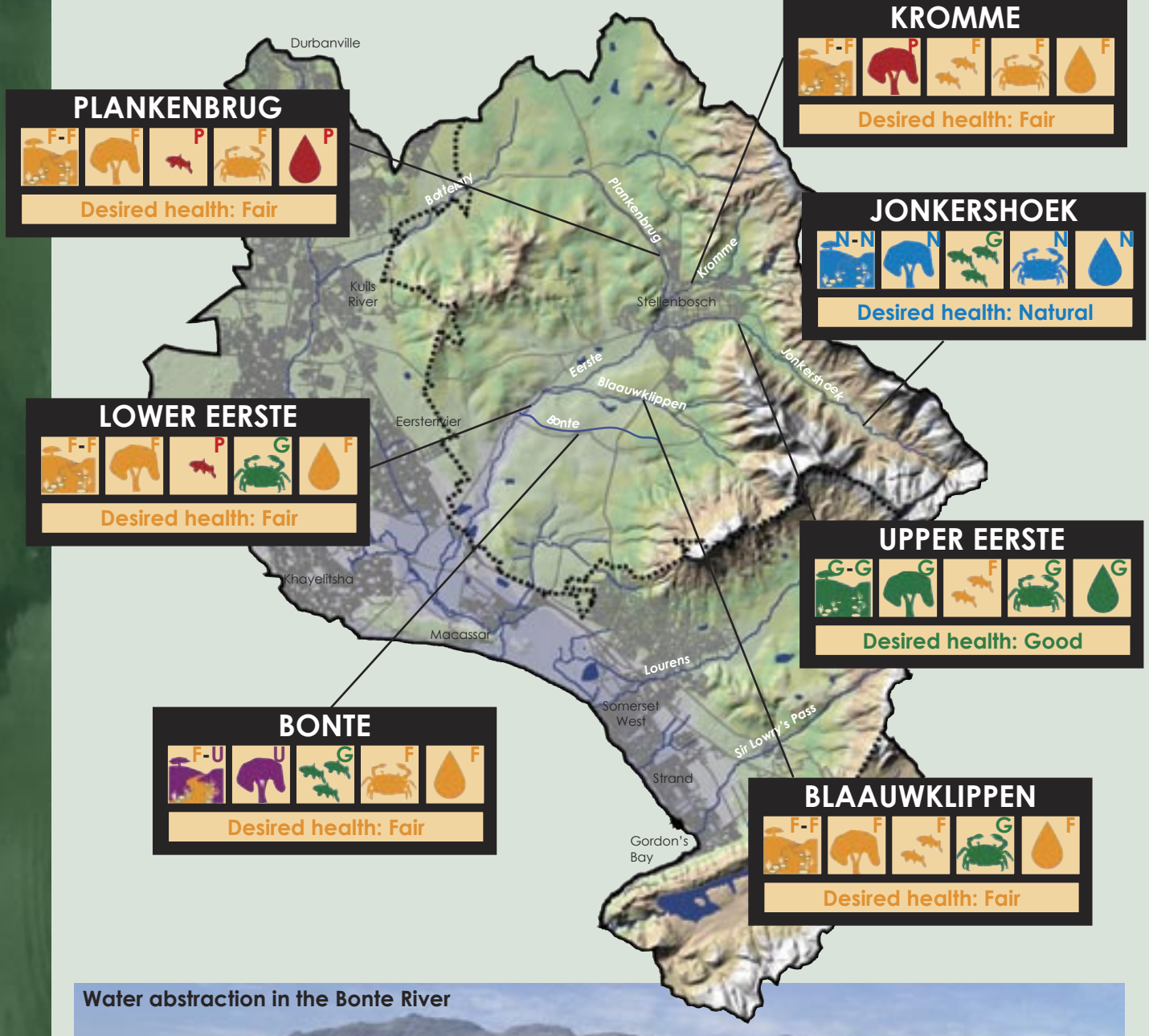
Eerste Estuary

The Eerste River estuary passes through coastal dunes near Macassar before entering False Bay. The estuary is small, with its dynamics driven mainly by river flow and wave energy. When the estuary is open it is only slightly tidal because of its high elevation. In addition, the high volume of poor quality freshwater input into the estuary from the Kuils River, as a result of wastewater discharges (see p. 22), has resulted in the 'freshening' of the estuary. Despite its small size and polluted condition, the estuary is an attractive area which supports a variety of aquatic birds.

Goods and Services (see p. 2)

- Conservation in the Hottentots Holland and Stellenbosch mountains
- Ecotourism and recreation: bird watching, hiking, picnicing, fishing and water sports
- Subsistence farming: arum lilies and thatch reed along the Kuils River
- Water supply: bulk water to Stellenbosch and Cape Town, vineyard and fruit irrigation along the Eerste River, schoolground/golfcourse irrigation, garden/nursery watering and livestock watering
- Flood attenuation in the wetlands of the lower Kuils River
- Breakdown and dilution of pollutants

Eastern Rivers (Eerste River)
Present State



Water abstraction in the Bonte River

Major Impacts

Alien Vegetation

Invasion of alien vegetation (wattle, poplars, spanish reed, kikuyu, nasturtiums) has replaced much of the indigenous riparian vegetation throughout the Eerste River catchment. Alien trees have modified the banks, confining and deepening the channel, thereby increasing erosion.

Alien Fish

The introduction of rainbow trout into the Eerste River has resulted in the disappearance of Berg River redfin. Other alien fish (catfish, carp) dominate the lower reaches of the Eerste River and have reduced numbers of Cape galaxias and Cape kurper.

Agricultural and Urban Development

Water quality and habitat diversity in the Plankenbrug River have been reduced by stormwater and wastewater discharges from Kyamandi and Stellenbosch. This river has been identified as a high risk area for human health (see p. 36).

Farming practices have removed indigenous riparian vegetation and straightened reaches of the Bonte and upper Plankenbrug rivers. This has severely reduced habitat integrity and the ability of the ecosystem to deliver goods and services.

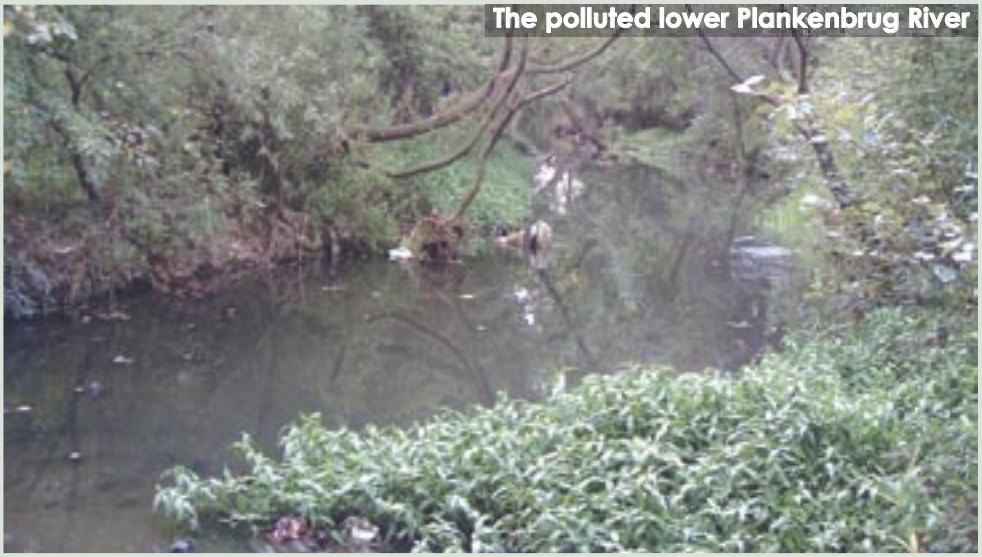
Flow Modification

The transfer of water from the Breede River into the upper Eerste River modifies the flow regime, which results in an elevated flow and turbidity in summer.

Water is abstracted and stored off-channel, or diverted for agriculture and domestic use. This results in reduced flows in the tributaries which concentrates pollutants and impacts on river health.

Management Actions

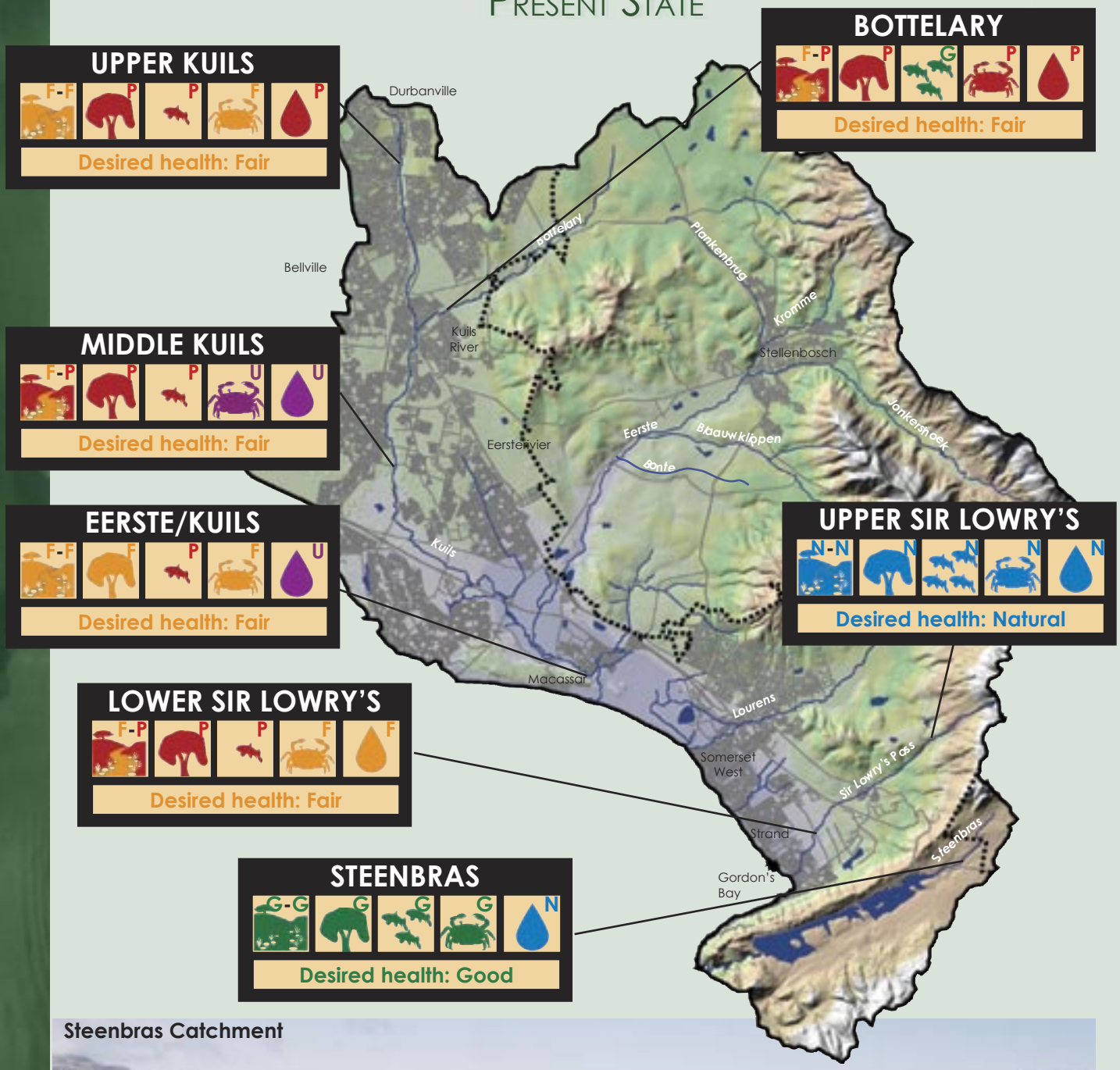
- Clear alien vegetation from the surrounding catchment and restore indigenous vegetation in riparian zones
- Use environmentally acceptable farming practices and maintain a buffer area along river banks
- Contact the Biodiversity and Wine Initiative (e-mail: bwi@sawb.co.za) for advice regarding acceptable farming practices in vineyards
- Improve stormwater and wastewater management in Kyamandi and Stellenbosch
- Restore natural channel shape and reintroduce meanders in the Bonte and upper Plankenbrug rivers
- Encourage existing abstractions from tributaries to take place during winter; instead store winter water for summer use in off-channel dams



The polluted lower Plankenbrug River

Nasturtiums are garden escapees that dominate river banks

Eastern Rivers (Kuils, Sir Lowry's Pass & Steenbras)
Present State




Steenbras Catchment

See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Lourens River.

Major Impacts

Alien Vegetation

Indigenous riparian vegetation has largely been removed from the Kuils, Bottelary and lower Sir Lowry's Pass river catchments. This has resulted in the invasion of alien plants (kikuyu, river gums, long-leaf wattle) and modified river banks (eroded, confined channels).

Alien Fish

The Kuils River is dominated by alien fish species (catfish, carp, tilapia), resulting in the near disappearance of the indigenous Cape kurper and Cape galaxias.

Urban and Peri-urban Development

Urban development in Kuils River and Gordon's Bay has resulted in the canalisation of the Kuils and Sir Lowry's Pass rivers, respectively. In the lower Sir Lowry's Pass River the channel has been diverted through the Gordon's Bay Wastewater Treatment Works. This modification has led to the historic river channel only receiving water during winter, causing a severe loss of ecosystem functioning.

Stormwater runoff, wastewater discharges and litter from urban and peri-urban areas in the catchments have resulted in serious water quality problems which pose a risk to human health. A loss of pollution-sensitive invertebrates and ecosystem functioning is evident.

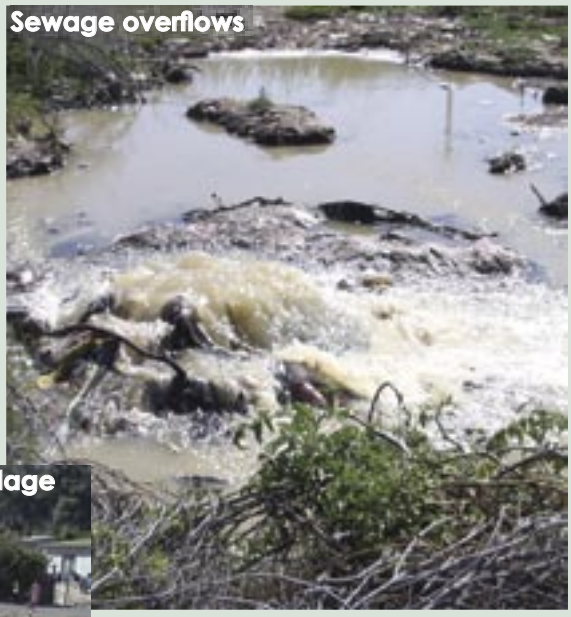
Flow Modification

The discharge of treated wastewater (see p. 22) has more than doubled the volume of water in the Kuils River and significantly altered its flow regime. As a result, the Eerste estuary is actively migrating westwards and has become progressively less saline (see p. 23).

Abstraction for agriculture in the Sir Lowry's Pass River catchment has drastically reduced flow in the lower reaches and this impacts negatively on the goods and services that the river provides (less dilution of pollutants).

Management Actions

- Clear alien vegetation from the surrounding catchment and the riparian zone and restore indigenous riparian vegetation
- Improve management and monitoring of wastewater discharges/ spills and stormwater runoff in urban and peri-urban areas
- Improve management and monitoring of water abstraction in the Sir Lowry's Pass River. Discourage any new on- or off-stream dams
- Explore ways to reduce the volume of water in the Kuils River (e.g. re-use of treated wastewater)
- Improve the water quality and rehabilitate habitat in the Bottelary River as this river is one of the few locations where Cape kurper occur



Sewage overflows

Sir Lowry's Pass village

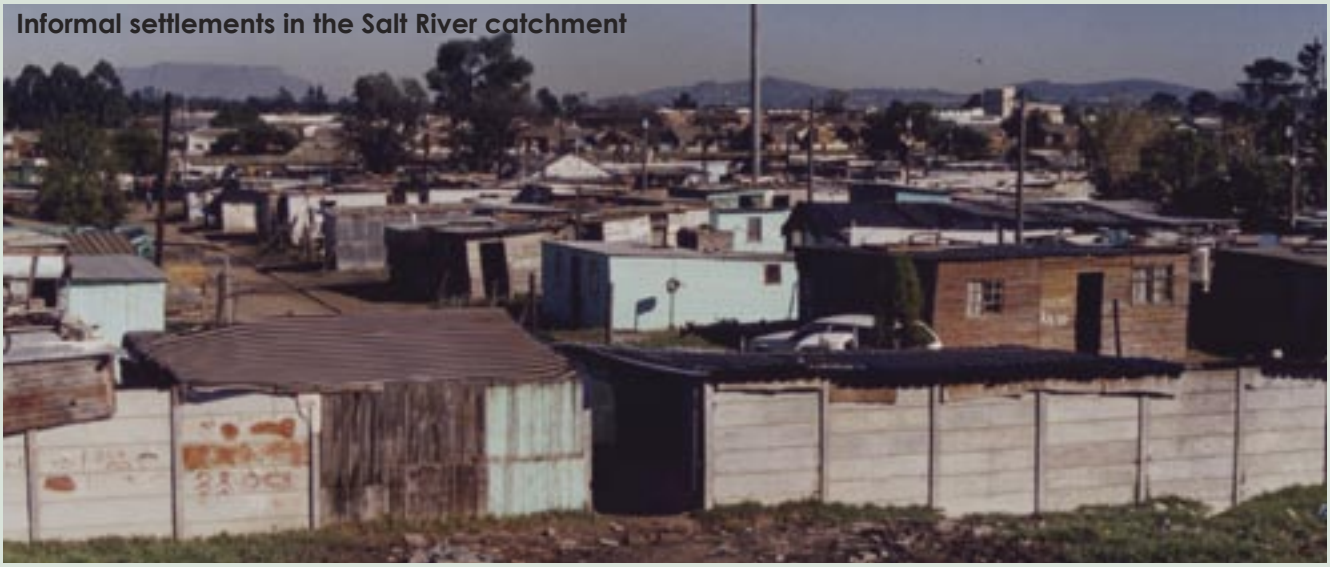
Central Rivers

The Salt and Hout Bay* rivers are the two major rivers in the Central Management Area of the City of Cape Town. The Salt River consists of the Elsieskraal, Black and Liesbeek tributaries, which drain the Tygerberg Hills, the north-western portion of the Cape Flats and the east-facing slopes of Table Mountain, respectively. Many of these tributaries have been canalised (see p. 15).

Land-use in the catchment consists of largely natural areas in the upper Liesbeek (Kirstenbosch Botanical Gardens) and Elsieskraal (Tygerberg Nature Reserve) catchments; less densely populated residential development in the Liesbeek (Newlands) and upper Elsieskraal (Welgemoed) catchments; and highly urbanised areas (Athlone, Bonteheuwel and Joe Slovo) in the Black/Vygekraal River catchments.

Treated wastewater is discharged into the Black River from the Athlone (73 million cubic metres per year) and Borchards Quarry (12 million cubic metres per year) Wastewater Treatment Works.

Informal settlements in the Salt River catchment



* See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Hout Bay River.


Reed Comorant

Blouvlei

Blouvlei, part of the Century City complex, consists of 8 hectares of constructed wetlands and another 8 hectares of seasonal salt pans and Sand Fynbos. The vlei preserves one of the largest fragments of natural Cape Flats habitat and is extremely valuable to conservation. This wetland houses 177 species of indigenous plants, 120 bird species, as well as various mammals, fish, amphibians and reptiles. A network of trails allow visitors to view the natural resources of Blouvlei.


Blouvlei with Century City in the background

Table Mountain National Park

The Park encompasses the Cape Peninsula Mountains that stretch over a distance of about 60 km from Signal Hill in the north to Cape Point in the south. Within its boundaries are the world-renowned Table Mountain World Heritage Site and the Cape of Good Hope. The Park is a fynbos "hot-spot" and is globally renowned for its extra-ordinarily rich, diverse and unique flora and fauna (see p. 38 to 41). There are at least 111 endemic invertebrates and one endemic vertebrate, the Table Mountain ghost frog.

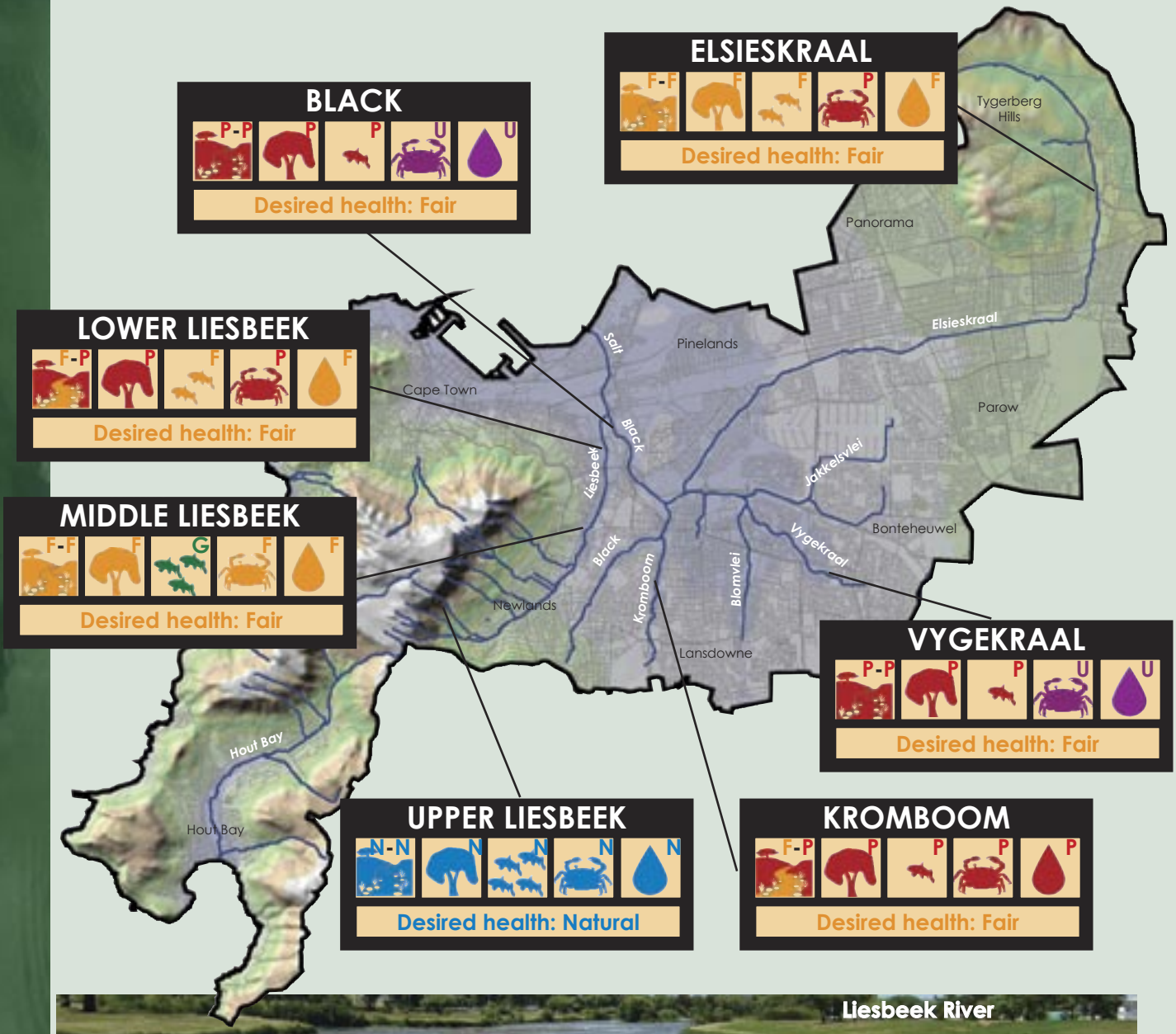
Some examples of the flora are (clockwise starting top left): *Morea insolens, Disa uniflora, Sparaxis tricolor, Serruria aemula, Morea neopavonia* and *Disa ferruginea*.


Endemic flora

Goods and Services (see p. 2)

- Conservation in the Table Mountain National Park
- Ecotourism and recreation: bird watching, hiking, picnicing and fishing
- Water supply: bulk water to Cape Town, schoolground/golfcourse/ sportsfield irrigation and garden watering
- Breakdown and dilution of pollutants
- Flood attenuation in the Elsieskraal River

Central Rivers (Salt)
Present State



See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Hout Bay River.

Major Impacts

Alien Vegetation

Most of the indigenous riparian vegetation has been removed and replaced by invading alien plants (kikuyu, poplars, wattle).

Water hyacinth clogs the water surface of the Black River, depleting oxygen, smothering aquatic life, fostering mosquitoes and restricting water flow. This requires continual clearing and maintenance. Mechanical removal of water hyacinth causes large scale river bed disturbance. A range of aquatic weed control methods are available for managing specific problem plants (see p. 42).

Alien Fish

The lower Liesbeek, Elsieskraal and Black rivers are dominated by alien fish (carp, catfish and tilapia). Competition for food or habitat and predation has caused the near disappearance of indigenous Cape galaxias.

Urban Development

Most of the rivers flow through densely populated urban areas and have been canalised with a resultant loss of goods and services (ability to process and dilute waste).

Poor water quality in the middle and lower reaches results from wastewater discharges, stormwater runoff and litter disposal. This reduces ecosystem functioning and poses a risk to human health. Monitoring of the Black and Vygekraal rivers over recent years has shown a decreasing trend in water quality and ecological functioning. The state of these rivers has deteriorated from poor to very poor over the past few years.

Management Actions

- Control littering and rubble dumping along river reaches in densely urbanised areas
- Clear alien vegetation and encourage, where possible, landscaping with indigenous plants, particularly along the Elsieskraal and Liesbeek rivers
- Improve monitoring and management of stormwater runoff and wastewater discharges/spills from urban areas
- Involve communities in the rehabilitation of riverine habitat and river health initiatives (see p. 47)
- Discourage new canalisation and where possible, remove concrete lining of canals to rehabilitate riverine habitat for aquatic life
- Support the Integrated Aquatic Weed Control Programme which manages the removal of nuisance aquatic plants (see p. 42)

Stormwater runoff and litter in the Jakkalsvlei Canal

Water Hyacinth

Northern River Systems

The Diep*, Sout, Silverstroom/ Buffels and Modder rivers drain the Northern Management Area of Cape Town. Although this management area is fairly undeveloped at its northern-most extent, there is some agriculture (wheat), and large areas are severely invaded by alien vegetation (port jackson willow).

Major urban areas are Malmesbury, Milnerton, Tableview, Durbanville, Mamre and Atlantis. The northern areas of Tableview and Durbanville are rapidly expanding, although development is currently being constrained by the limited existing infrastructure (stormwater and wastewater).

Most of the bulk water supply to this area comes from Voëlvlei Dam in the neighbouring Berg River catchment#. Other water sources to the area are the Cape Flats and Atlantis aquifers (see p. 13 and p. 33).

The Melkbosstrand Wastewater Treatment Works has a capacity of 5.5 million cubic metres per year. Some of the treated wastewater is discharged into the Sout River. Treated wastewater from the Wesfleur Wastewater Treatment Works (4 million cubic metres per year) is used to recharge the Altantis Aquifer (see p. 33).

Typical landscape of the Sout River Catchment

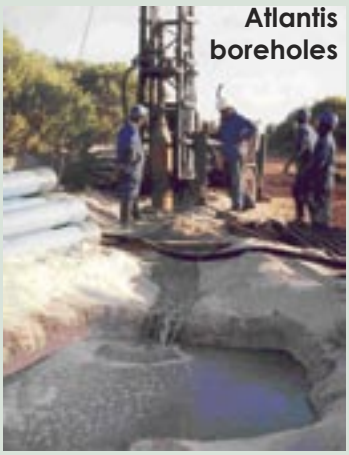
* See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Diep River

See State-of-Rivers report: Berg River System (2004)

Atlantis Water Supply Scheme

Atlantis groundwater development began in 1976, initially as a sole water supply to Atlantis. This supply is now supplemented by water from the Berg River. The Atlantis Water Scheme comprises two wellfields at Witzand on the Sout River and at Silverstroom. The Witzand aquifer is artificially recharged with treated wastewater from the Wesfleur Wastewater Treatment Works. Water from the Silverstroom River is blended with aquifer water, which is treated and distributed to Atlantis and Mamre.

This scheme has supplied good quality water for more than two decades to an area where the lack of suitable water supply would have hampered development.



Atlantis boreholes

Silverstroom spring

Silverstroom Spring

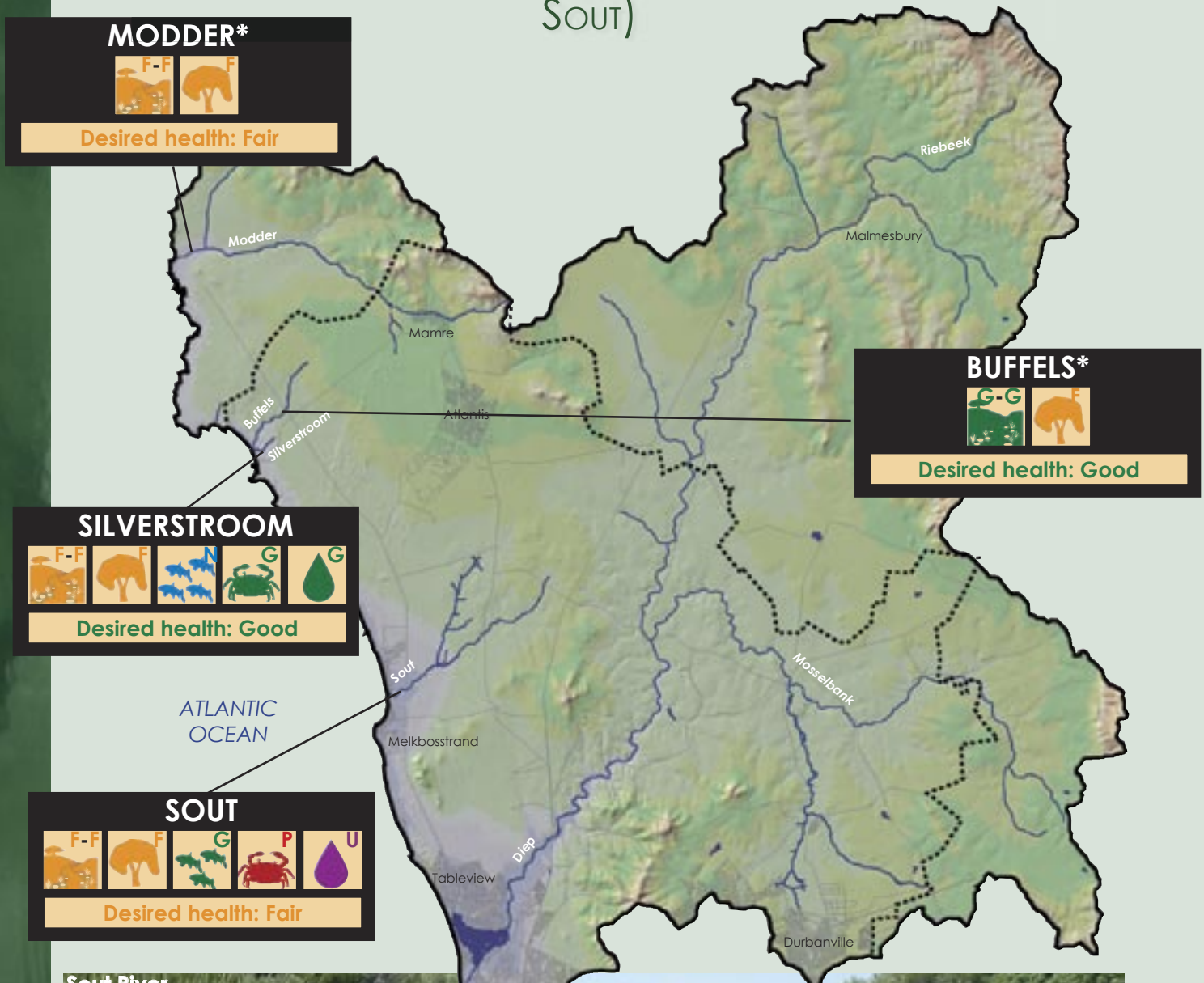
Silverstroom Spring which arises on the edge of the Atlantis dunefield is an important component of the Atlantis Water Supply Scheme, where good quality water from the spring is used to blend with groundwater. Water abstraction at the Silwerstroom weir results in drastic daily water level fluctuations, which has had a negative impact on the ecological health of the system and may have contributed to filamentous algal growth in the pool upstream of the weir. This practice has, however, recently stopped due to clogging of pump equipment by algae. A consequence of this has been that the Silwerstroom Spring now flows over the weir and some ecological functioning of the system downstream has been restored.

The spring is also unique since it supports a population of the endemic Cape galaxias (*Galaxias zebratus*). This Gondwanaland relic's closest relatives are found in Australia, New Zealand and South America. Solutions are being sought to alleviate algae growth, allow sustainable abstraction and leave sufficient flow for the system and the Cape galaxias population to remain healthy.

Goods and Services (see p. 2)

- Ecotourism and recreation: Bird watching, camping, picnicing, fishing and water sports
- Water supply: bulk water to Atlantis/Mamre, vineyard irrigation along the Diep and Riebeek rivers, livestock watering, sportfields irrigation and garden watering
- Flood attenuation at Rietvlei
- Breakdown and dilution of pollutants

Northern Rivers (Modder, Buffels, Silverstroom and Sout)



* The assessment of fish, macro-invertebrates and water quality in the Modder and Buffels rivers was not possible as these rivers were dry at the time of the survey

See State-of-Rivers report: Diep, Hout Bay, Lourens and Palmiet River Systems (2003) for information on the health of the Diep River.

Major Impacts

Alien Vegetation

Disturbance of the natural riparian vegetation has resulted in dense infestation of black wattle and port jackson willow. This has reduced runoff and habitat integrity, particularly in the Sout and Modder rivers.

Alien Fish

Mozambique tilapia occur in the lower Sout River, where they complete with indigenous Cape galaxias for food.

Agricultural and Peri-urban Development

Reduced flows in the Silverstroom and Sout rivers are due to abstraction of water for domestic and agricultural use, respectively. Wastewater discharges into the Sout River increases nutrients (phosphates). A reduction in habitat integrity and loss of goods and services (dilution of pollutants) are evident. The presence of large numbers of Cape galaxias in the lower Sout and Silverstroom rivers is unique for such short coastal rivers and needs to be conserved.

Management Actions

- Clear alien vegetation along the banks of the Sout and Modder rivers and maintain cleared areas
- Re-introduce indigenous riparian vegetation to alleviate sedimentation problems
- Manage the Sout River to ensure refuge areas (pools and runs/riffles) are maintained for indigenous fish species
- Maintain environmental flow requirement in the Silverstroom River below the City of Cape Town weir
- Monitor and manage wastewater discharges into the Sout River

Mozambique tilapia

Abstraction point on Silverstroom River

Port jackson willow infestation in the Sout River Catchment

Rivers and Public Health

Urban runoff, especially from informal settlements, impacts negatively on river water quality. Urban rivers are also polluted by inadequately treated wastewater, sewer overflows or collapsed sewers, as well as from agricultural and industrial runoff. Such wastewater and runoff carries waterborne human pathogens (including bacteria, viruses, fungi and parasites) into rivers. These disease-causing micro-organisms are of great concern as they pose a threat to public health.

Although none of greater Cape Town's rivers are designated recreational or bathing areas, children are regularly seen swimming in highly polluted rivers, while homeless people use river water for washing. Where urban river water is used for irrigation of sports fields or crops, it should be treated first. Contact with highly polluted river water can cause skin rashes, ear and throat infections, gastro-intestinal illnesses and other diseases, some of which could be serious or fatal.

It is impractical and expensive to test river water for the presence of all human pathogens and hence indicator organisms such as faecal coliforms or *Escherichia coli* are used. A series of samples, taken over a period of time should be analysed to determine the fitness for use of the water resource.

The Target Water Quality Ranges (TWQR) for domestic and recreational use as laid out in the South African Water Quality Guidelines (1996) are indicated in the information box on page 37. It is important to note that if the levels of faecal coliforms or *E. coli* are within the TWQR's, the risk to public health is unlikely or negligible. However, many of greater Cape Town's urban rivers are unfit for domestic or recreational use. In fact, the Guidelines are often exceeded, necessitating special measures such as notice boards and public warnings to keep people out of polluted rivers.

Litter in stormwater systems

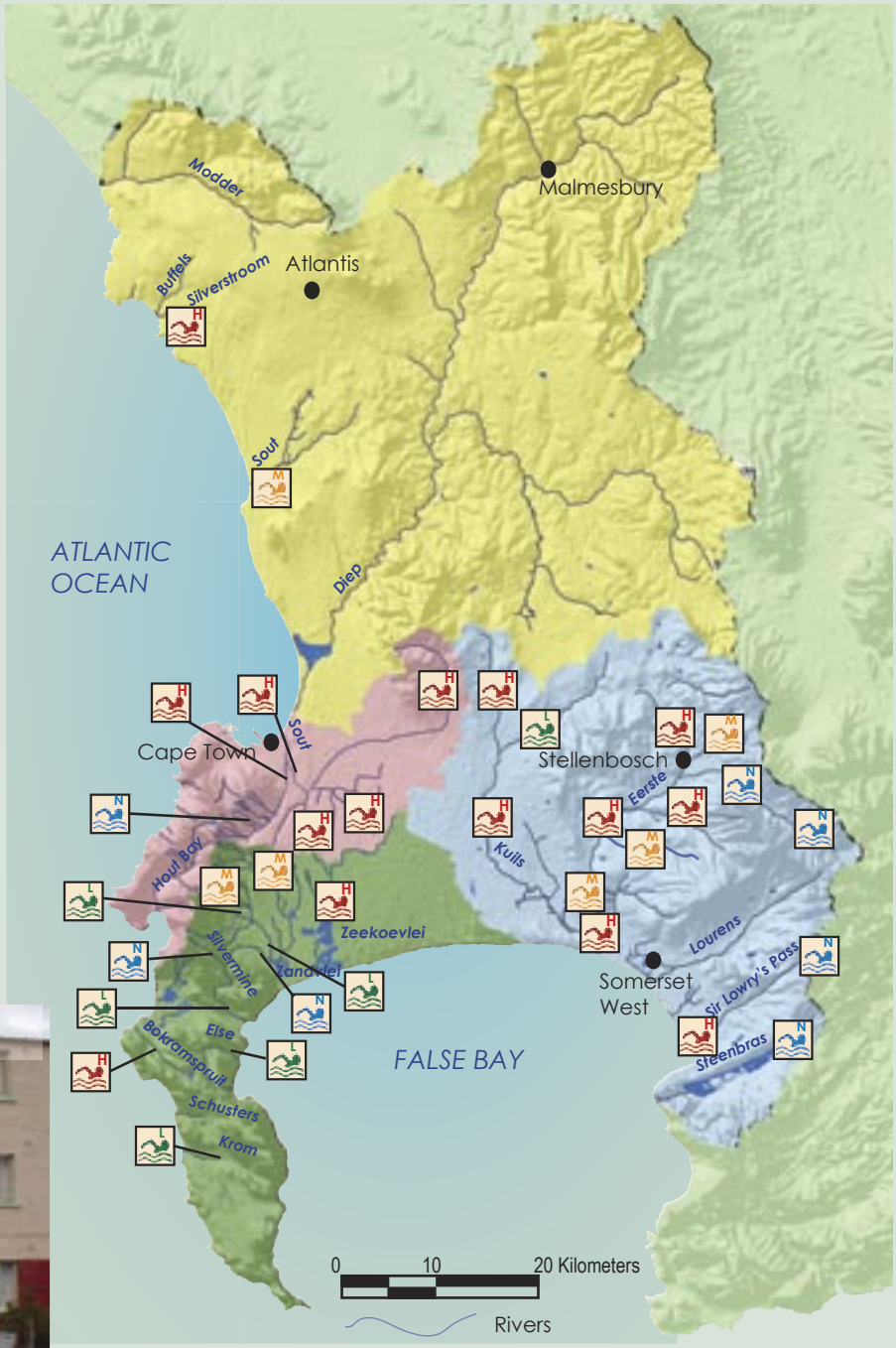
Management Actions

- Treat wastewater to the Department of Water Affairs and Forestry's water quality specifications
- Upgrade sewerage systems to minimize sub-standard effluent, overflows and leakages
- Re-use treated wastewater rather than discharging it into urban rivers
- Infiltrate urban stormwater, especially from informal settlements, into the soil where possible
- Maintain and improve monitoring of, and public reporting on, urban river water quality
- Maintain and improve law enforcement of non-compliance to by-laws pertaining to microbiological pollution of rivers
- Upgrade existing legislation, particularly relating to agricultural runoff
- Conduct epidemiological investigations into the occurrence of waterborne diseases in greater Cape Town, as well as the cost of poor water quality

The present water quality was assessed according to its suitability for domestic and recreational use. The indicator, faecal coliforms, was used in the assessment. Of all the study sites assessed, only three were found suitable for potable use, with a low to medium health risk. These sites are in the upper Liesbeek, Sir Lowry's Pass and Jonkershoek rivers.

The fitness for recreational use is indicated on the map. The following colour-coded icons show the level of risk posed to recreational users:

- Negligible risk (within TWQR)
- Low risk
- Medium risk
- High risk



Warning sign posted along the Bokramspruit River

Microbial Water Quality Guidelines

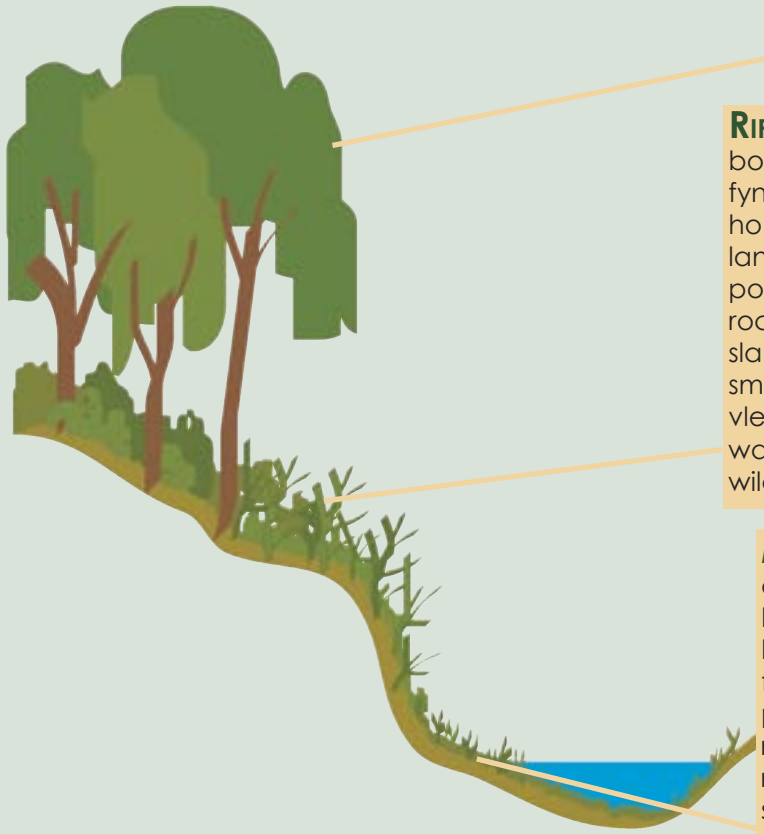
Designated water use	Potential Health Risk associated with faecal coliforms counts per 100 ml			
	Target Water Quality Range	Low	Medium	High
Potable water (drinking)	0*	0 - 1	1 - 10	>10
Full or partial contact recreation (swimming & bathing)	<130#	130 - 600	600 - 2000	>2000

*Negligible risk of microbial infection
#Small risk of gastro-intestinal effects. The presence of faecal coliforms indicate a possible risk to human health, but the absence of indicators does not guarantee no risk.

Flora of Greater Cape Town's River Catchments

The Cape Peninsula falls within the Fynbos Biome and consists of fynbos interspersed with afromontane forests, strandveld and renosterveld. While the natural fynbos flora (proteas, ericas and restios) is still largely intact on mountain slopes and summits, development on the Cape Flats and west coast has drastically reduced the natural landcover. Several species of plants have become endangered or are locally extinct.

Common riparian plants that grow next to rivers and wetlands in greater Cape Town are shown in the diagram below:



Riparian Trees

bladder-nut *(Diospyros whyteana)*
Cape holly *(Ilex mitis)*
red-alder *(Cunonia capensis)*
silky-bark *(Maytenus acuminata)*
small ironwood *(Olea capensis)*
spoonwood *(Cassine schinoides)*
water tree erica *(Erica caffra)*
white-alder *(Platylophus trifoliatus)*
white milkwood *(Sideroxylon inerme)*
wild almond *(Brabejum stellatifolium)*
wild-peach *(Kiggelaria africana)*

Riparian Shrubs

bog rice-bush *(Cliffortia strobilifera)*
fynbos star-apple *(Diospyros glabra)*
honey-bells *(Freylinia lanceolata)*
lance-leaved waxberry *(Morella serrata)*
pom-pom shrub *(Berzelia abrotanoides)*
rock false candlewood *(Maytenus oleoides)*
slangbessie *(Lycium ferrocissimum)*
smalblad *(Metrosideros angustifolia)*
vleiknopbos *(Berzelia lanuginosa)*
water white alder *(Brachylaena nerifolia)*
wild cotton *(Asclepias fruticosa)*

Marginal Vegetation

arum lily *(Zantedeschia aethiopica)*
bracken fern *(Pteridium aquilinum)*
bulrush *(Typha capensis)*
fluitjiesriet *(Phragmites austalis)*
palmiet *(Prionium serratum)*
restios *(Ischyrolepis subverticillata)*
rush *(Juncus lomatophyllus)*
sedge *(Isolepis prolifer)*
sundew *(Drosera trinervia)*
wire grass *(Aristida junciformis)*

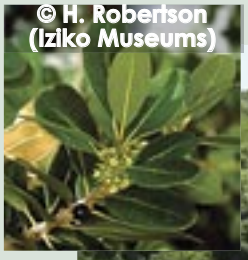

Bulrush

Bulrush (*Typha capensis*)
This naturally occuring plant grows to more than 1 m and is found in wetlands and rivers. It prevents soil erosion, acts as a filter system and breaks the force of water, especially during floods. Bulrushes are a food source and provide shelter for several aquatic animals and therefore enhance biodiversity.

These plants, however, can become invasive in constantly damp areas where the flow has been stabilised (through wastewater or stormwater discharges) and there is an increase in nutrient supply. Encroaching rushbeds are considered a problem, reducing access to water, blocking flow and causing hayfever. Rushbeds in Rondevlei, Zeekoevlei, Langvlei, Rietvlei and Kuils River are encroaching and need to be managed through control programmes.

White Milkwood *(Sideroxylon inerme)*

Milkwoods form dense thickets in coastal areas of False Bay, where they are adapted to withstand strong coastal winds. They may reach a great age but most large specimens on the Peninsula were lost to early tree-fellers. The species is now protected in South Africa where three specimens have been proclaimed National Monuments, namely, the 'Post Office Tree' in Mossel Bay, the 'Treaty Tree' in Woodstock, Cape Town and the 'Fingo Milkwood Tree' near Peddie in the eastern Cape. These trees have been used for general purpose timber and in African medicine. They also grow well in gardens.



Milkwood thickets along the Eerste River

Cape Holly *(Ilex mitis)*

There are about 400 holly species, most of which occur in Asia and America. Only one species, Cape holly, occurs in South Africa. It is very widely distributed in Africa, growing on the banks of rivers and moist spots in woods and forests. Small white, sweetly-scented flowers occur in spring or early summer.

The plant has many uses. Leaves are used as a soap, which when rubbed, produce a lather. Woodcutters used the leaves to wash themselves in forest streams. This use is depicted in the Zulu name *iPhuphuma* (it foams out) and the Venda name *Mutanzwa-khamelo* (milk-pail washer). Buckboards, wagon-wheel spokes and heels of ladies shoes were once made from this wood. The wood is still used for implement handles and furniture, as well as fuel.

Arum Lily *(Zantedeschia aethiopica)*

This elegant lily is usually found in open marshes and stream banks where it sometimes grows in clusters. It is widely cultivated and is an informal source of income throughout the Cape Flats. Commercial viability of this flower for export needs to be explored.

The hollow formed by the cone-shaped white flowers makes an ideal home for the arum lily frog where they ambush visiting insects. Their cream colouring blends well with the lily and a dusting of pollen improves the camouflage. These frogs are becoming increasingly rare through the destruction of its wetland habitat and harvesting of lilies.

Arum lilies

Arum lily frog

Fauna of Cape Town's River Catchments

A remarkable variety of animals are found in river systems of the Cape Peninsula, some of which are confined to specific sites and are threatened or even extinct. Below are some examples:


Hippopotamus

Hippopotamus *(Hippopotamus amphibius)*

Hippopotami were once widespread throughout the Cape Peninsula. Van Riebeeck (1652) wrote of a hippopotamus in a swamp which is now Church Square in Cape Town. Today, Rondevlei Nature Reserve houses the only hippopotami found in the south western Cape. These hippos were introduced in 1981 and 1983, with the first calf being born in 1984.

Cape Clawless Otter *(Aonyx capensis)*

These large otters are found in the Fynbos Biome's rivers, dams and coastal waters where they feed on shellfish, crabs, frogs and fish. They are most active at dawn and dusk. Their tracks and scats are often the only evidence of their presence.

Freshwater Crab *(Potomonautus perlatus)*

The freshwater crab, a primary diet of the Cape clawless otter, favours rocky streams where it feeds on small fish, tadpoles, carrion and food particles on leaves. Other predators are the water dikkop, giant kingfisher and mongooses.


Cape clawlesss otter


Freshwater crab

Table Mountain Ghost Frog *(Heleophryne rosei)*

These endangered frogs are confined to seven perennial streams in forests on the high eastern slopes of Table Mountain. They are well-camouflaged and hide in narrow rocky crevices. Reservoir construction and alien plants have threatened their existence. Tadpoles can take two years to develop into adults and are well adapted to fast-flowing streams.


Table Mountain ghost frog

Western Leopard Toad *(Bufo pantherinus)*

Distribution of this endangered toad is limited to the Cape Peninsula and Cape Flats. Threats to its existence are natural habitat loss and the construction of obstacles (roads, buildings and canals). Adults emerge from burrows and migrate to rivers, wetlands, dams and pools during winter to mate. Motorists in Westlake and Kirstenhof should take care when driving during mass migrations of toads. River maintenance should take place outside of breeding periods (July to January) and ensure that the habitat of the toads is conserved in these areas.


Western leopard toad

Freshwater Fish

The rivers of the Cape Floristic Region have relatively few indigenous freshwater fish species (19 species) for an area of this size, but a remarkable 16 species are found nowhere else in the world. Of these 19 species, only three have been recorded in the rivers of greater Cape Town. The Berg River redfin *(Pseudobarbus burgi)* has only been recorded in the Eerste River whereas the Cape kurper (*Sandelia capensis)* is more widespread, especially in rivers on the Cape Flats. The Cape galaxias (*Galaxias zebratus)* is the most widespread, occurring in virtually all inland waters, from mountain streams to slow flowing rivers of the Cape Flats and in rivers that cease flowing during summer.

Ongoing genetic and morphological studies indicate that greater Cape Town is likely to be home to at least two species of Cape galaxias, a longer and more striped mountain form and a shorter, clearer-bodied lowland form. All indigenous species are very small and none exceed 12 cm in size. In terms of human use, they have little angling value but are becoming increasingly popular in water features in indigenous fynbos gardens. These fish can only be kept with permits obtained from CapeNature.

Although they have no angling value, indigenous fish are a very important component of the food web and ecosystem of greater Cape Town's rivers. This is because with so few indigenous fish species occurring (several rivers have only one species), the value of each species within the food web increases. These species are referred to as keystone species.

The Berg River redfin is now extinct in the Eerste River because of the introduction of rainbow trout into the river for angling purposes almost 100 years ago. The future survival of indigenous fish in Cape Town rivers is dependent on adequate flow, good habitat diversity and quality and minimizing the impact of invasive alien fish and plants.

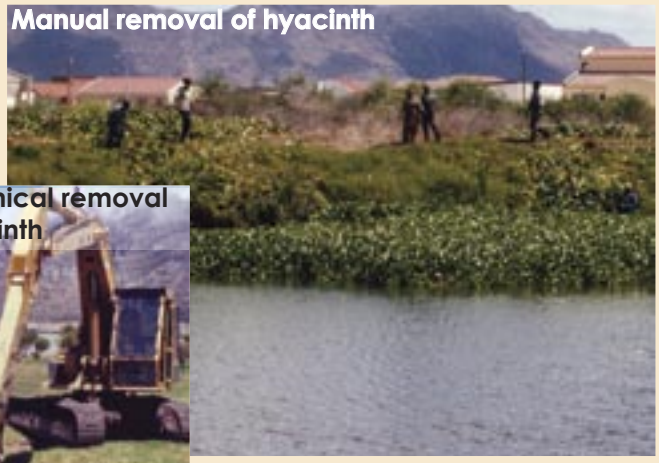
Indigenous fish of greater Cape Town's rivers

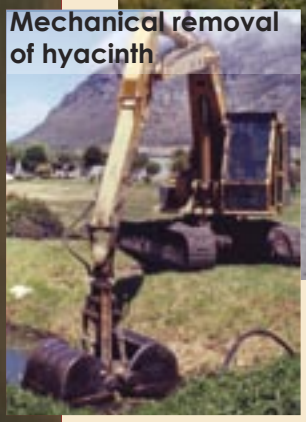

Cape kurper


Berg River redfin


Cape galaxias

Alien Flora and Fauna in Greater Cape Town's River Catchments


Manual removal of hyacinth


Mechanical removal of hyacinth

Integrated Aquatic Weed Control

A variety of alien aquatic weeds have invaded many of Cape Town's water bodies. An integrated approach to managing this problem, using carefully selected manual, mechanical, chemical or bio-control methods is used. Use of approved, registered herbicides on chronic infestations of water hyacinth (e.g. Black River) is recommended and cost effective. Introduction of biocontrol agents on parrot's feather, water lettuce, Kariba weed and South American water fern provides effective control. Manual methods are used under certain circumstances, but the use of heavy mechanical equipment can result in significant disturbance of habitats and is discouraged during frog and bird breeding seasons.


Port jackson willow

Port Jackson Willow (*Acacia saligna*)

This plant was imported from Australia in the 1800's for dune reclamation. It is also utilised for shelter, tanbark and fodder. Areas invaded by the willow are fynbos, woodland, coastal dunes, roadsides and watercourses. The Cape Flats, in particular, is covered by dense thickets of Port Jackson. A rust fungus has been introduced for the biological control of the plant. It causes large galls, which reduce reproduction and vegetative growth.


Galls from rust fungus

Blue Echium (*Echium plantagineum*)

Blue echium, or Patterson's curse, originates from Europe and Asia. It was introduced for the production of honey and as an ornamental garden plant and is now a Category 1* weed. Its pretty blue flowers are often seen along roadsides and disturbed agricultural lands and riparian zones. The hairy stems cause skin irritations and are poisonous to livestock.


Echium

***The National Department of Agriculture has divided alien invader plants into categories. Category 1 invader plants must be removed and destroyed immediately in accordance with the Conservation of Agricultural Resources Act (Act 43 of 1983).**

Invasive alien fish

European settlers in Cape Town soon realised that local indigenous freshwater fish had little angling value, and were interested in stocking local rivers and dams with European species such as brown trout *(Salmo trutta)* and carp *(Cyprinus carpio)* and North American species such as largemouth bass (*Micropterus salmoides)* and rainbow trout (*Oncorhynchus mykiss)*. Improvement in overseas transport allowed the introduction and stocking of these species into Cape waters from 1890 onwards. From 1960, fish species from other parts of South Africa [e.g. banded tilapia (*Tilapia sparmanni),* Mozambique tilapia (*Oreochromis mossambicus)* and sharptooth catfish (*Clarias gariepinus*)] were also stocked into Cape waters to improve angling.


Banded tilapia


Carp

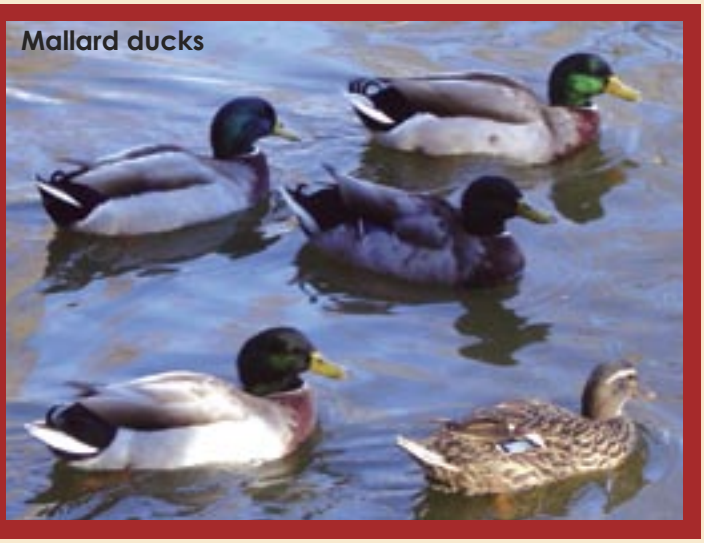
The small local indigenous fish were not evolved to cope with the predatory pressures of rainbow trout and largemouth bass or with the competitive pressures of carp and banded tilapia and soon disappeared from waters when the invasive species became abundant. Carp also degrade habitat quality of rivers and dams through their feeding habits - they eat aquatic plants and stir up the bottom sediments, changing clear water bodies into a muddy brown. Alien fish like carp, Mozambique tilapia and sharptooth catfish are now the mainstay of a substantial recreational angling industry centered around Zandvlei, Zeekoevlei and Rietvlei. Rainbow trout are occasionally caught in the upper reaches of the Eerste and Lourens rivers.


Sharptooth catfish

European Mallard Duck *(Anus platyrhynchos)*

This attractive duck is an ancestor of the domestic duck and originates from Eurasia and North America. The duck has established itself on many southern Cape water bodies and crossbreeds easily with the indigenous Yellowbilled Duck. This interbreeding poses a threat to the genetic integrity of the native duck, which is a protected species.

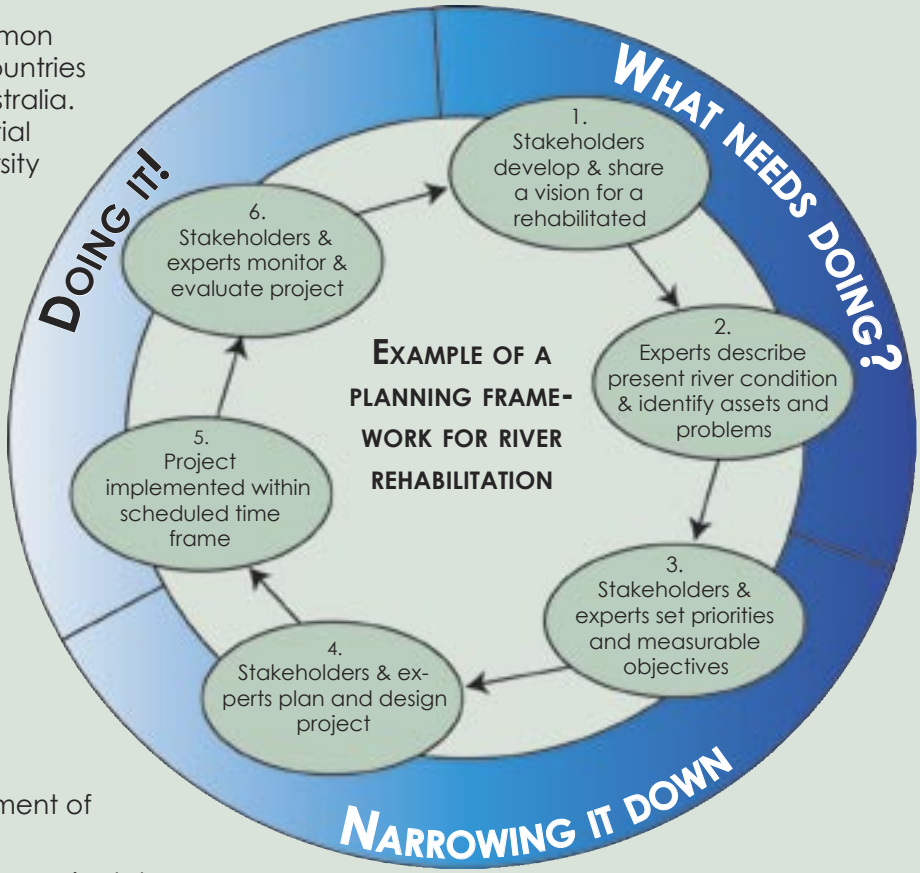
Although control measures have long been in place, there are still a large number of mallards in the south western Cape. The City of Cape Town and CapeNature advocate the removal of this species from the wild. Mallards are controlled at Zandvlei, Rondevlei, Rietvlei and Zeekoevlei.


Mallard ducks

Conserving Our Natural Resources

We all live in river catchments, use water and should all take responsibility for looking after rivers. By doing this, we can continue to use and benefit from rivers now and in the future.

River Rehabilitation is common practice in many first world countries such as USA, England and Australia. It is an activity that allows partial to full recovery of the biodiversity and ecological processes of river ecosystems. Efforts can vary from catchment-level measures (removal of invasive trees invading a catchment) to site-specific interventions (stabilisation and vegetation of an eroded riverbank).



River rehabilitation cannot occur in isolation. It is a step by step process involving river experts (ecologists and engineers), provincial and local authorities, riparian land-owners and other river users (e.g. anglers, eco-tourists) towards the gradual improvement of a river.

River and wetland rehabiltation projects have been initiated in greater Cape Town to address flood management, water quality impacts, sedimentation, erosion and improving public amenity value. Projects initiated include:

- Upgrading of Diep, Hout Bay and Keysers rivers;
- Bank rehabilitation of Kuils River;
- Improvement of Moddergat River;
- Flood control measures in Silvermine River; and
- Restoration of Rondevlei wetland.

In South Africa, the national Working for Water and Working for Wetland programmes is an excellent example of river rehabilitation. It uses poverty alleviation funding to create jobs for eradication of invasive alien plants from catchments and rivers. These actions are aimed at increasing water flow and improving water quality in rivers and wetlands, as well as assisting the recovery of indigenous fauna and flora.

The rehabilitated Moddergat River

This section deals with some of the activities that impact on water resources and the actions that can be taken to minimise the impacts and thereby aid river and wetland rehabilitation activites.

Wise Water Use

Water is our most precious resource and we need to use it wisely. Some tips for saving water are:

- Adhere to water restrictions;
- Re-use bath and sink water to water your garden;
- Check and repair all water leaks;
- Place a 'hippo' bag or filled plastic bottle in your toilet cistern;
- Take a quick shower instead of a bath;
- Close your taps when cleaning your teeth or shaving;
- Fit new houses with water saving devices (e.g. dual flushing toilet systems, low-flow shower heads, water-saving urinals); and
- Implement block water tariffs in the agricultural sector.

Dual-flushing toilet system

Groundwater Use

Well point and borehole users are encouraged to adhere to water restrictions. The cumulative effect of many abstractions from groundwater has a significant impact on river flow. Groundwater is particularly important in contributing to the flow of rivers in summer, which provides refuge areas for aquatic life. Well points and boreholes should not be established in riparian zones or green belts.

Groundwater users are required to register with the City of Cape Town and make use of their official borehole signs. Use of groundwater needs to be effectively managed.

Lotus wetlands sustained by groundwater


Algal bloom


Animals are often injured by litter

Domestic Wastewater

When washing with detergents in or near rivers, chemicals (phosphates) are added to the water. These chemicals are harmful to aquatic life, and often lead to eutrophication (algal blooms) and other water quality problems.

By using environmentally friendly soaps and not allowing wash water to end up in rivers, the impacts of our activities on rivers could be reduced. Home owners can positively influence water quality by restricting their use of harmful substances (herbicides, pesticides and other chemicals).

Solid Waste Disposal

Solid waste materials (rubble, paper, plastics, faecal matter) reduce the aesthetic value of rivers and impact on water quality. As a result, users of rivers suffer. Solid waste also causes injury, suffering and often death to animals, such as fish, otters and mongooses, living in or near the rivers.

Litter discarded in streets ends up in stormwater systems and eventually in rivers. Litter and rubble should be disposed of or recycled at designated facilities. Legislation on plastic bags has visibly reduced the impact of litter in rivers.

Conserving Our Indigenous Plants and Fish

Alien plants and fish do not occur naturally in our rivers. They were introduced by man and impact on our indigenous riverine plants and animals. Alien plants replace indigenous plants, destabilise river banks, reduce runoff to rivers and reduce habitat diversity. Alien fish prey on our indigenous fish, compete with them for food, or degrade their habitat.

You can protect or conserve our indigenous plants and fish by:

- Informing authorities about the location of alien plants and fish;
- Protecting the best areas for conservation;
- Removing alien plants along rivers and planting indigenous plants;
- Joining a volunteer clearing or hack group;
- Buying alien plant products (firewood, furniture); and
- Obtaining permission to stock rivers/dams with alien fish.


Angler holding Mozambique tilapia


Poplars along the Else River destabilise its banks

How To Get Involved

Catchment forum meetings, arranged by the Department of Water Affairs and Forestry and the City of Cape Town, serve as an interface between the public and City officials in reaching agreements on development and the management of water resources within a catchment. Apart from the catchment forums, communities can play a pivotal role in river management by 'adopting-a-river' or forming 'friends' groups, such as the following:

Friends of the Liesbeek

The 'Friends of the Liesbeek River' are a committed group of volunteers who assist with managing the river. Their activities include arranging guided walks, maintaining pathways and signage, litter clean-ups, alien vegetation removal and planting of indigenous species. To join this group, contact Liz at wheelers@xsinet.co.za or (021) 671 4553.

Liesbeek River

Friends of Die Oog

The 'Friends of Die Oog' are a group of local residents committed to conserving this small wetland in the Sand River Catchment. The area is managed as a bird sanctuary and is being rehabilitated. Once all alien fish have been eradicated, Cape kurper and Cape galaxias will be re-introduced along with appropriate indigenous aquatic plants. To become involved, contact the group at (021) 712 1314.

Other WESSA Western Cape Friends Groups working in greater Cape Town are:

Friends of Blaauwberg Conservation Area, Friends of the Cape Of Good Hope, Friends of Constantia Valley Greenbelts, Durbanville Environment Forum, Friends of Helderberg Nature Reserve, Hope Group, Friends of Lions Head and Signal Hill, Friends of Meadowridge Common, Montagu Nature Garden Association, Friends of Newlands Forest, Friends of the Paarden Eiland Wetlands, Friends of Rietvlei, Friends of Rondebosch Common, Scarborough Conservation Group, Friends of Silvermine Nature Area, Friends of Simon's Town Coastline, Simon's Town Flora Conservation Group, Friends of The Glen, Friends of Tokai Forest, and Friends of Tygerberg Hills. Contact Michelle at 021-701 1397 for any Friends Groups details.

Keysers River Restoration Project

This project is a partnership between civil society, local government and industry that aims to improve and then maintain a particularly degraded section of the Keysers River. 'River wardens' have been appointed to undertake some of the river rehabilitation tasks and to inspect the river for signs of pollution. To participate in this initiative contact michelle@wessa.wcape.school.za or (021) 701 1397.

Consult local offices at CapeNature (Tel: 021-866 1570), Department of Water Affairs and Forestry, Regional Office: Bellville (Tel: 021-950 7100) and where applicable the City of Cape Town (Tel: 021-487 2205; 021-684 1000) for guidance regarding river and catchment issues. They are there to help you.

Glossary

Alien species are fauna and flora that have been introduced intentionally or by accident from other countries. Not all alien species are invasive.

Biodiversity is the variety and variability among living organisms and the ecological complexes in which they occur.

Biota refers to the community of plants and animals which live in rivers and wetlands.

Desired health provides an indication of the envisioned ecological state of the river and is determined by considering the ecological importance and sensitivity of the specific river ecosystems.

Ecological importance refers to the diversity, rarity or uniqueness of the habitats and biota and the importance of protecting these ecological attributes.

Ecological sensitivity refers to the ability of a specific ecosystem to tolerate disturbances and to recover from certain impacts.

Ecological Reserve is the quality and quantity of water that is required to protect the aquatic ecosystems of a water resource.

Eutrophication is the result of high nutrient concentrations (nitrogen and phosphorus), which causes excessive plant growth in water resources.

Fitness for use is a judgement of how suitable the water quality is for its intended use or for protecting the health of aquatic ecosystems.

Fauna is the collective term for animals living in a particular area.

Flora is the collective term for plants growing in a particular area.

Gross Geographic Product (GGP) is the total value of all final goods and services produced within the economy in a geographic area for a given period.

Gross Domestic Product (GDP) is the total market value of all final goods and services produced in a country for a given period.

Indigenous species are the fauna and flora occurring naturally in an area.

Instream refers to "within the river channel".

Mean Annual Evaporation (MAE) is the average evaporation over a year.

Mean Annual Precipitation (MAP) is the average rainfall (including snow, hail and fog condensation) over a year.

Mean Annual Runoff (MAR) is the average yearly available stream flow at a point in the river which has been calculated over a long period of time (usually 50 years or more), assuming a constant level of development.

Marginal vegetation refers to plants growing at the edge of the riparian zone.

Present health is a measure of the present ecological state of the river during the time of the survey. This is expressed as a river health category which reflects how much the river has changed from its natural state.

Recharge is the process where water is added to an aquifer, for example, from rainfall.

Riparian habitat refers to the habitat on the river bank.

Riparian zone is the area adjacent to a river or water body that forms part of the river ecosystem. The riparian zone plays an essential role in the functioning of the river ecosystem. It is characterised by frequent inundation or sufficient flooding to support vegetation distinct from the surrounding area.

Runoff is water that is not absorbed by the soil and flows to lower ground, eventually draining into a stream, river or other water body.

spp. is an abbreviation for a grouping of species. Species (sp.) refers to the single unit of biological classification and diversity.

Further Reading

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Web pages to explore are:

CapeNature: www.capenature.org.za

City of Cape Town: www.capetown.gov.za

Department of Environmental Affairs and Tourism: www.deat.gov.za

Department of Water Affairs and Forestry: www.dwaf.gov.za

South African National Parks: www.sanparks.org

Water Research Commission: www.wrc.org.za

Working for Water: www.dwaf.gov.za/wfw

River Health Programme: www.csir.co.za/rhp

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