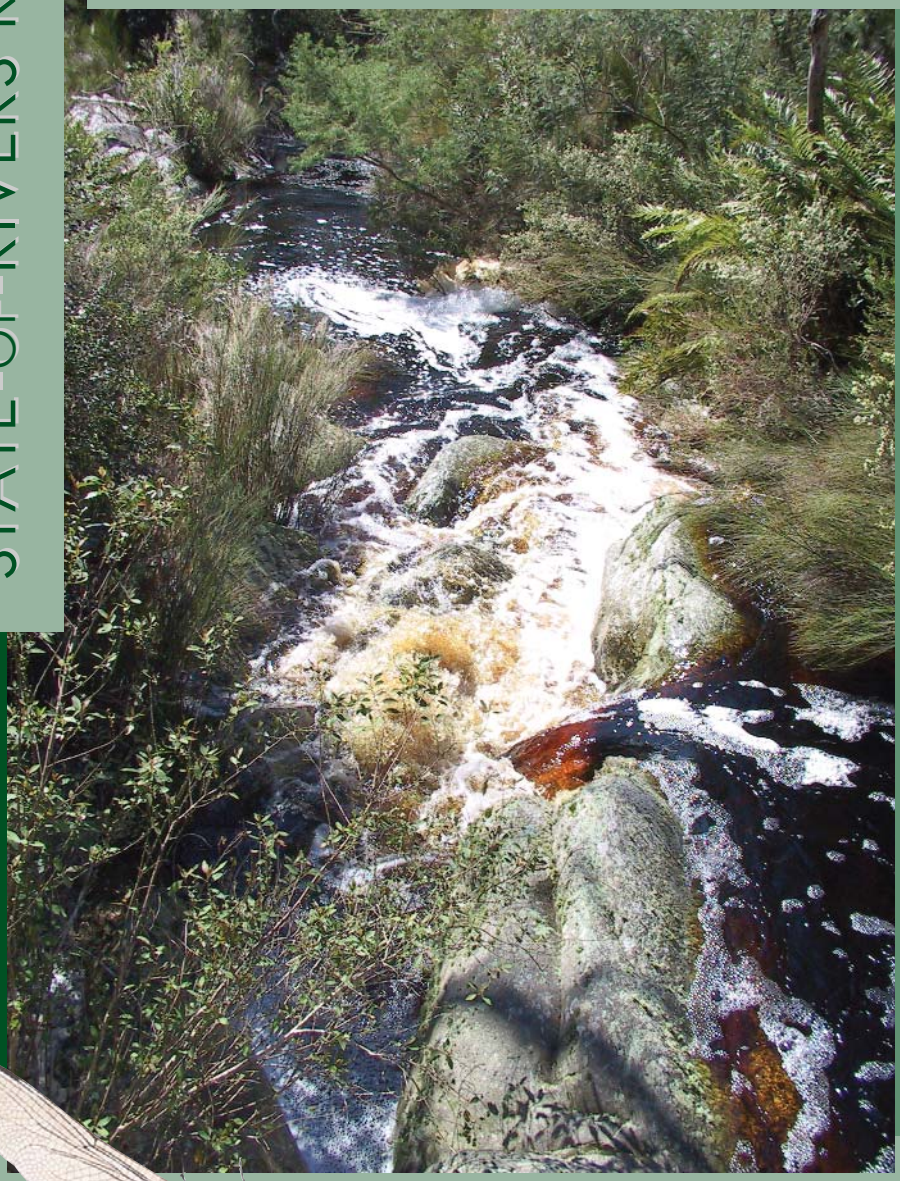
STATE-OF-RIVERS REPORT

The Hartenbos and Klein Brak River Systems - 2003



River Health Programme

Participating Organisations

Department of Water Affairs and Forestry

Department of Environmental Affairs and Tourism

Water Research Commission

Norwegian Agency for Development

Western Cape Nature Conservation Board

Mossel Bay Municipality

City of Cape Town

CSIR Environmentek

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Context

The health of the rivers presented in this report is based on the findings of surveys that were conducted in the Hartenbos and Klein Brak Rivers as part of the River Health Programme, Western Cape.
These surveys took place during 2001 and 2002.

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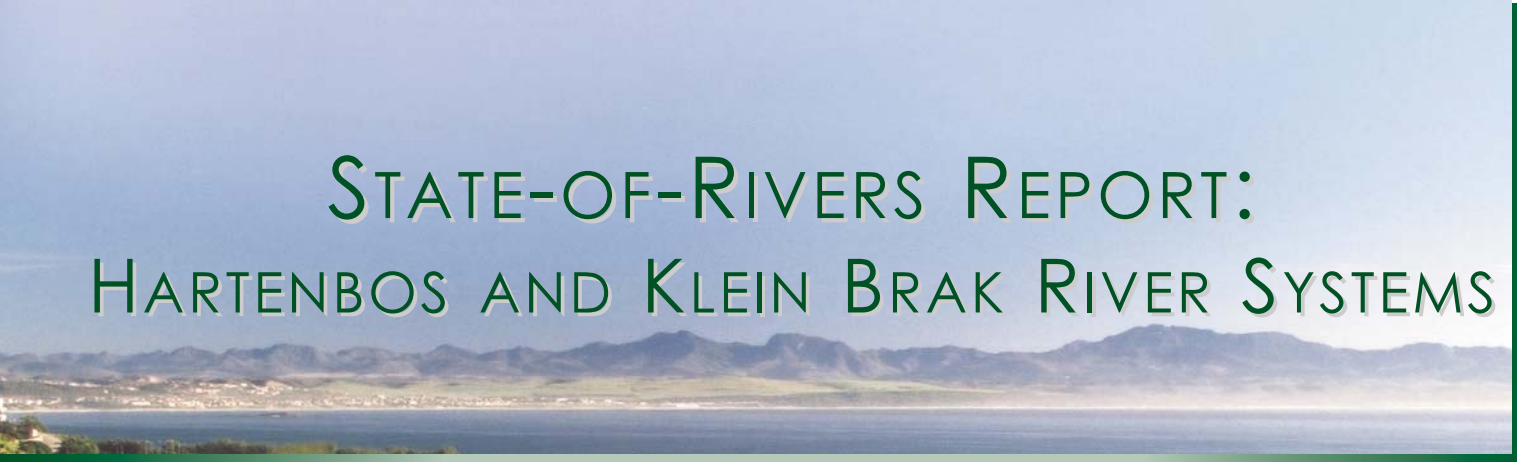


State-of-Rivers Report:
Hartenbos and Klein Brak River Systems

Contents

Introduction

Why do we monitor and report on river health?

The term "river health" refers to the ecological condition and ecological importance of a river, in the same way as health would refer to the condition of a person or an economy. It is important to monitor and manage the health of rivers, as these systems are central to human welfare and economic development. The following are examples of river goods and services:

- food and medicinal plants
- water for agricultural, industrial and domestic use
- tourism, recreational and cultural use
- enhanced property values

Knowledge of the impacts on a river provides insight into why the river is in its present health. Examples of human activities that can impact on rivers include:

- water abstraction
- disturbance to river-bank and -bed (e.g. dam and bridge construction in rivers; presence of invasive alien fauna and flora)
- development below the 1 in 50 year floodline (e.g. housing, sand mining, vineyards, forestry)
- discharge of waste water or effluent of poor quality

What is the River Health Programme?

Water resources in South Africa are limited and it is critically important to manage these effectively for the sustainable development of the country. It is projected that South Africa will experience water stress or water scarcity by 2025 under all United Nations population growth projections. The annual average amount of water available per person in South Africa has been projected to decrease by more than 50% from over 1 300m^3 in 1990 to less than 700m^3 in 2025 as a result of population growth. With the impending water shortages, it is important that we find new and innovative ways of monitoring and managing this valuable resource.

As the custodian of water resources in South Africa, the Department of Water Affairs and Forestry (DWAF) is responsible for the protection of the health of aquatic ecosystems and for ensuring their sustainable use. As a key part of this responsibility, the River Health Programme (RHP) was initiated in 1994.

The RHP assesses the biological and habitat integrity of rivers (e.g. fish, aquatic invertebrates and riparian vegetation). This assessment enables us to report on the ecological state of our river systems in an objective and scientifically sound manner. Information from the RHP allows for the identification of those areas where unacceptable ecological deterioration is taking place. The programme provides an assessment of the effectiveness of existing river management policies, strategies and actions.

The Water Act requires that the health of aquatic ecosystems is monitored and the RHP monitoring results can in turn, be used to support certain legal principles (e.g. water quality and quantity of the ecological reserve) contained in the National Water Act (1998) and National Environmental Management Act (1998).

What are State-of-Rivers Reports?

State of the Environment (SoE) reporting has developed over the past decade in response to a need for more informed environmental decision-making. In line with this, the RHP addresses monitoring and dissemination of information on river health to:

- serve ecologically sound management of rivers, and
- inform and educate people regarding the health of our rivers.

The national SoE report for South Africa uses the Driving Force-Pressure-State-Impact-Response framework to explain what is causing environmental change, how good or bad the conditions are (present health) and what we can and are doing about it (management actions). Aligned with this framework, SoR reporting describes the present state and trends of river conditions, the driving forces and pressures on the rivers, and the policies and management actions in place to manage the rivers.

A special format has been developed for RHP reporting, i.e. a simplified and summarised State-of-Rivers (SoR) report or a SoR poster. The vision of the RHP is that SoR reports will eventually cover all major river systems of South Africa. The reports will be updated on a regular basis.

Who can be Involved in the RHP?

The RHP is a collaborative venture and the partnerships that have been established are critical to its successful implementation. At the national level, DWAF plays the leading role while the Department of Environmental Affairs and Tourism (DEAT) and the Water Research Commission (WRC) are active partners. Implementation of the RHP is co-ordinated at a provincial scale. Each province has a network of implementers who work together under the leadership of a Provincial Champion. The protocols and procedures that make up the RHP are available to any institution that would like to become involved in river health monitoring.

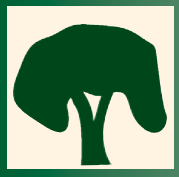
River Health Indices

What are River Health Indicators?

Many physical, chemical and biological factors influence river ecosystem health, e.g. geomorphology, hydrological and hydraulic regimes, water quality and in-stream and riparian habitats and a host of biological processes. For practical purposes, the RHP focuses on selected ecological **indicator groups** that are representative of the larger ecosystem and are feasible to measure. **Indices** are used to present data in an easy-to-understand format. The following indices have been used in this report:

Index of Habitat Integrity (IHI)

The availability and diversity of habitats are major determinants of the biota that will be found in a specific ecosystem. Knowledge of habitat quality is important in an overall assessment of ecosystem health. The IHI assesses the impact of disturbances such as water abstraction, flow regulation and river channel modification on the riparian zone and in-stream habitats. The IHI icon shows the river and river bank that is colour-coded according to the health of the in-stream and riparian habitat respectively.



Riparian Vegetation Index (RVI)

Healthy riparian zones maintain the form of the river channel and serve as filters for sediment, nutrients and light. Plant material from the riparian zone is an important source of food for river animals. The structure and function of riparian vegetation is altered when vegetation removal, cultivation, construction, inundation, erosion, sedimentation and alien vegetation occur within or close to the riparian zone. The RVI is a measure of the degree of modification from the natural of the riparian zone.

South African Scoring System (SASS)

Aquatic invertebrates (e.g. insect larvae, beetles, mussels, snails, crabs, worms) require specific habitats and water quality conditions for at least part of their life cycle. Changes in invertebrate community composition and structure reflect changes in river conditions. Invertebrates are good indicators of recent localised conditions in a river. SASS is a relatively simple index, based on invertebrate families found at a site.

Fish Assemblage Integrity Index (FAII)

Fish are good indicators of long-term influences on a river reach and the general habitat conditions within the reach. The number of fish species (indigenous or alien), the different size classes and the health of fish, are all indicators of river health. The FAII is an expression of the degree to which a fish assemblage deviates from its undisturbed condition. The FAII was adapted to make it applicable to rivers with low fish diversities.

Water Quality

Assessment of water quality provides an indication of the suitability of the water for aquatic ecosystems. This assessment is based on phosphates, nitrates, nitrites, ammonia, suspended solids, dissolved oxygen, pH and conductivity measured of water samples taken throughout the year, from each sampling 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 an indication of the envisioned future ecological state of the river and is based on ecological considerations, the need for sustainable development and management actions.

River Health Category	Ecological Perspective	Management Perspective
Natural N	No or negligible modification	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; lower abundances and sometimes higher e.g. opportunistic species	Multiple disturbances associated with the need for socio-economic development
Poor P	Loss of some species; alien species invasion; disrupted population dynamics; species are often diseased	High human densities or extensive resource exploitation

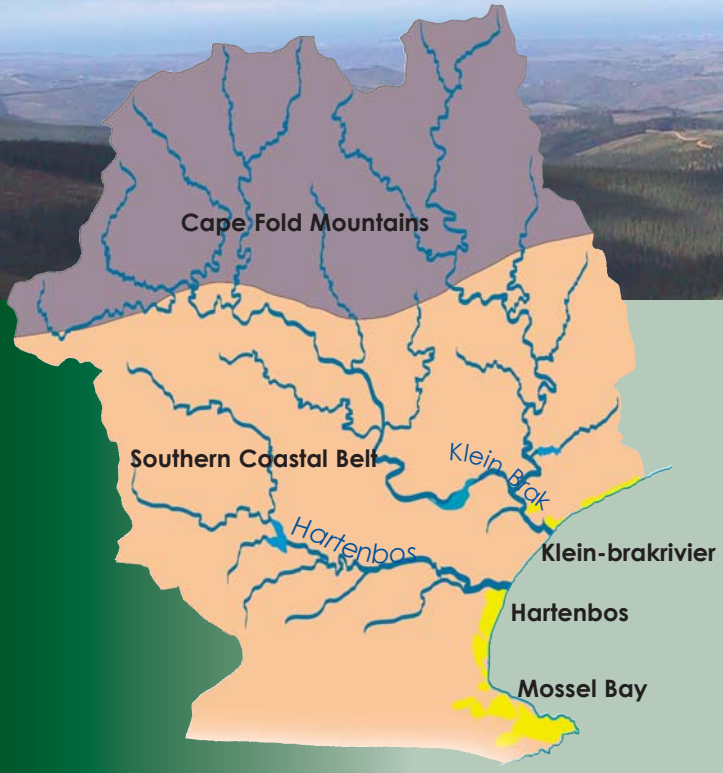
Overview of the Hartenbos and Klein Brak River Catchments

CATCHMENT CHARACTERISTICS

The Hartenbos and Klein Brak rivers are situated on the Cape south coast and are typical coastal river systems draining the Table Mountain Sandstone (TMS) formations of the Cape Fold Mountains. The TMS formations were deposited on eroded surface granite in stream channels and tidal flats of coastal plains and deltas that extended across the region about 450 million years ago. The sand, silt and mud deposits were transformed into sandstone by pressure and folded to form the Cape Fold Mountains, extending along the southern coast of South Africa to form the Southern Coastal Belt.

The Hartenbos and Klein Brak catchments are small and are characterised by high gradient streams that show a rapid response to rainfall events. Despite being peat-coloured due to the presence of dissolved material from decayed fynbos plants in the catchment, the water draining the TMS is of good quality and has a low conductivity, turbidity and pH.

	Hartenbos	Klein Brak
Catchment Size (km^2)	205	562
Main tributaries	Melkboom, Goedemoed	Palmiet, Kouma, Moordkuil, Leeukloof, Bosmans, Perdeberg
Geology	Bokkeveld shales, Kaaimans	Table Mountain Sandstone, granite, Kaaimans
Vegetation	Renosterveld	Renosterveld, Afromontane forest, Mountain fynbos
Mean annual precipitation (mm)	446	450-680
Mean annual evaporation (mm)	1 400	1 400
Mean annual runoff (m^3)	$5,7 \times 10^6$	$53,2 \times 10^6$
Mean annual temperature (^0C)	17	17

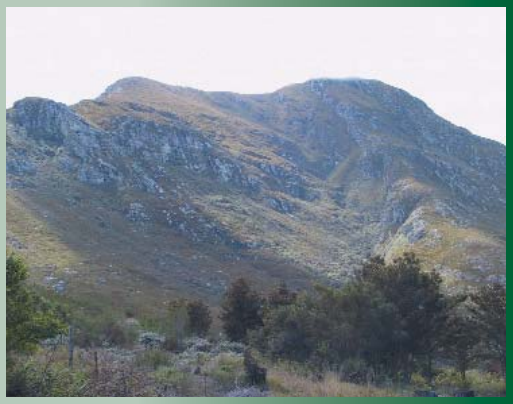


Ecoregion characteristics

Ecoregions are areas with similar natural characteristics such as physiography, climate, geology, soils and vegetation. Ecoregions also provide convenient boundaries for ecological assessments and for determining resource quality objectives. The ecoregions applicable to this report are the Southern Coastal Belt and the Cape Fold Mountains.

The Cape Fold Mountains

The headwaters of the Klein Brak River rise in this mountainous ecoregion. The terrain morphological types consist of plains with low relief (limited), table lands, high mountains with high relief, low mountains with high relief, closed hills with moderate relief and open hills with high relief. The folds from which the ecoregion name is derived, are clearly visible on the photograph (right). Indigenous mountain fynbos dominates with pockets of afromontane forests, mainly in river valleys. The altitude ranges from 200 to 1 750m above sea level and rock types include shale, tillite, sandstone and quartzitic sandstone.



The Southern Coastal Belt

The Hartenbos River and the lower reaches of the Klein Brak River fall within this ecoregion. The ecoregion is typified by plains with a low and moderate relief, closed hills with moderate relief, open hills with high relief and low mountains with high relief. Vegetation types include coastal forest, valley thicket, eastern thorn bushveld, coastal grassland (right), renosterveld and sand-plain fynbos. The altitude range from 0 - 600m. Rock types include quartzitic sandstone, shale, sand and biotite granite.

The Cape Floral Kingdom

The vegetation of the Hartenbos and Klein Brak catchments forms part of the Cape Floral Kingdom. The Cape Floral Kingdom is one of the worlds' six floral kingdoms and the only floral kingdom located entirely within one country. The Cape Floral Kingdom is remarkable because of the diversity of its flora and it has over 9 000 plant species, 80% of which are endemic to this region.

LAND-USE

LAND-USE IN THE CATCHMENTS

forest plantations (5%)

dryland crops (21%)

irrigated crops (3%)

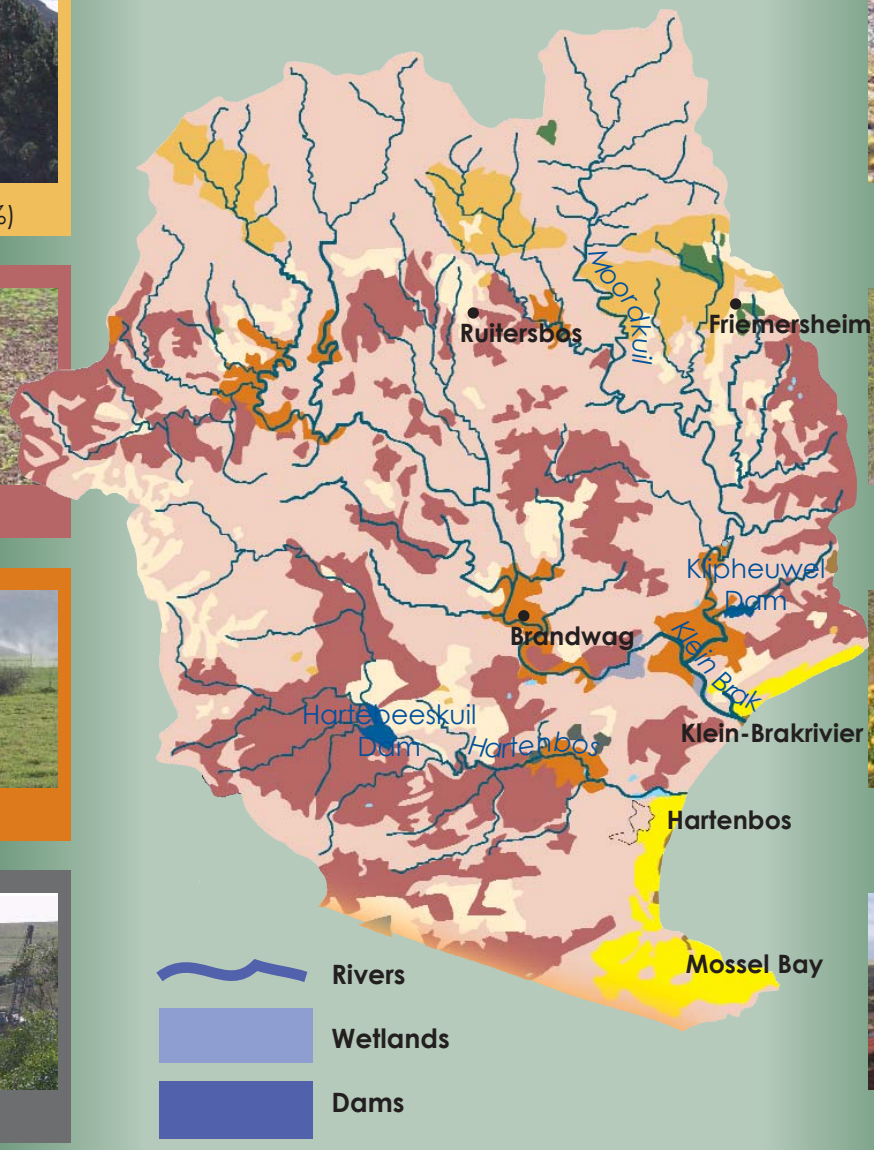
sand mining (<1%)

indigenous forest (<1%)

fynbos (61%)

grassland (7%)

urban areas (2%)

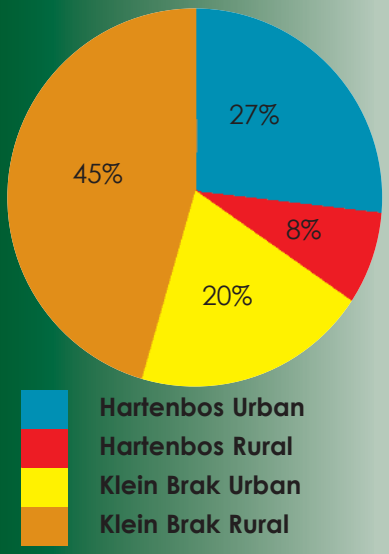


LAND-USE WITHIN THE CATCHMENTS is comprised of nature conservation, plantation forestry, grazing, limited agriculture, game farming and small rural settlements. Klein-Brakrivier and Hartenbos are the only relatively large towns. Other urban areas in the catchment are Ruitersbos (Forestry Station), Brandwag and Friemersheim.

Dams in the area

Dam	River	Capacity	Main Uses
Hartebeeskuil	Hartenbos	7.2 x 10^6 m^3	irrigation and livestock watering (7%)
Klipheuwel	off Klein Brak	4.2 x 10^6 m^3	Mossel Bay domestic (60%)

Population Distribution in the Region



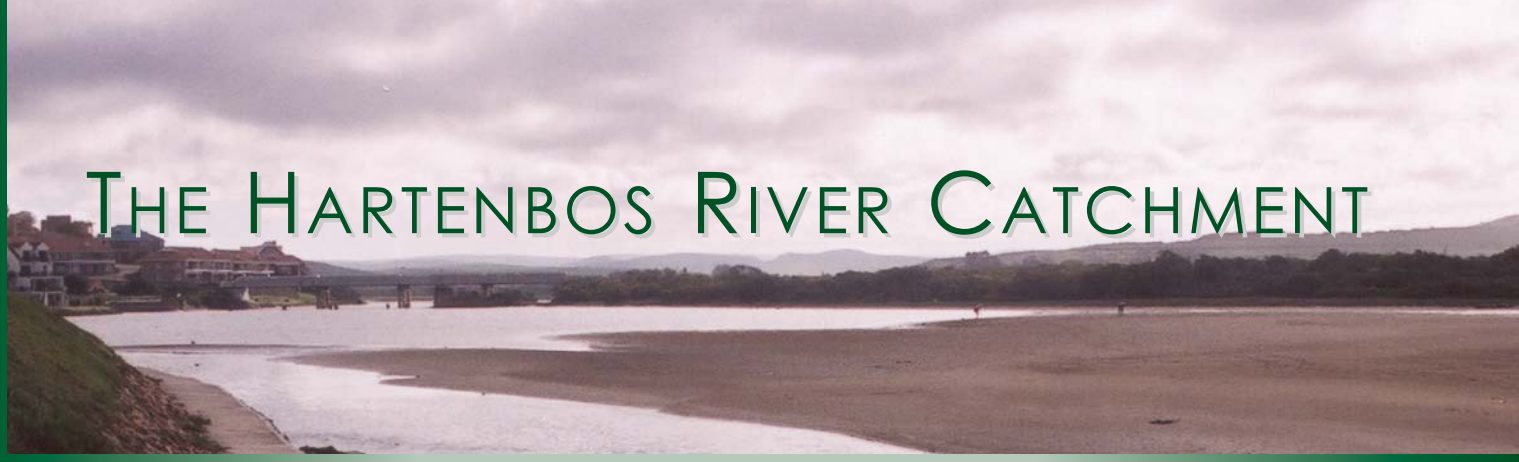
Population

The majority of people work in agriculture (cattle, sheep, poultry and game), forestry, nature conservation and in the towns of Klein-Brakrivier, Hartenbos or Mossel Bay. Commercial fishing and tourism are other major sources of income for the region.

The most commonly spoken language in the area is Afrikaans, followed by isiXhosa and English.

Economic Profile and Development Priorities

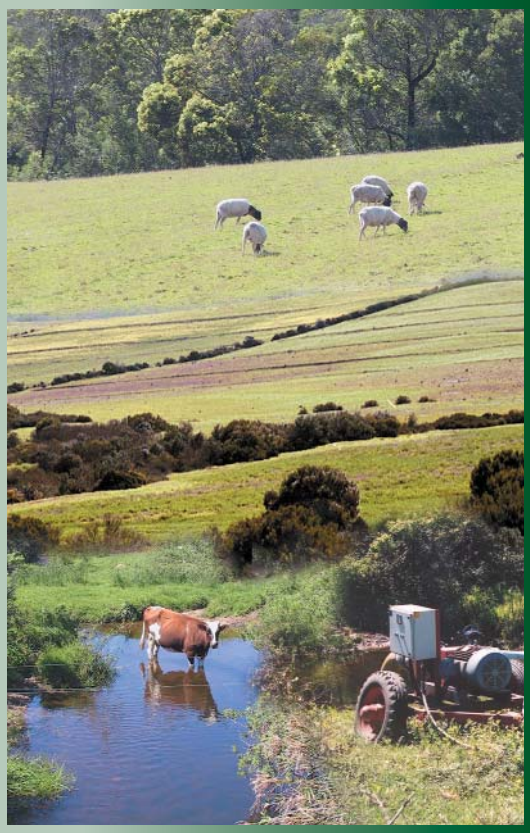
- Total population of the area is about 7000 people
- Estimated population growth is 3.1 % per year
- Migration occurs mostly from rural to coastal areas
- Agriculture, trade and services are the prominent economic sectors where the property and tourism market are growing
- Several game farms have been established within the past 10 years - a growing tourism attraction
- Water supply to the communities is mostly from town or regional schemes
- Irrigation from the Moordkuil River is probably close to its maximum development potential
- It is estimated that water supply to the Mossel Bay region will be sufficient for the next 20 years, except in the case of severe drought or unexpectedly high population growth in the area.
- Sewage treatment works in the area include: Brandwag, Friemersheim, Ruitersbos and Hartenbos. Some informal settlements, without sewage systems along the Hartenbos River will eventually be relocated.

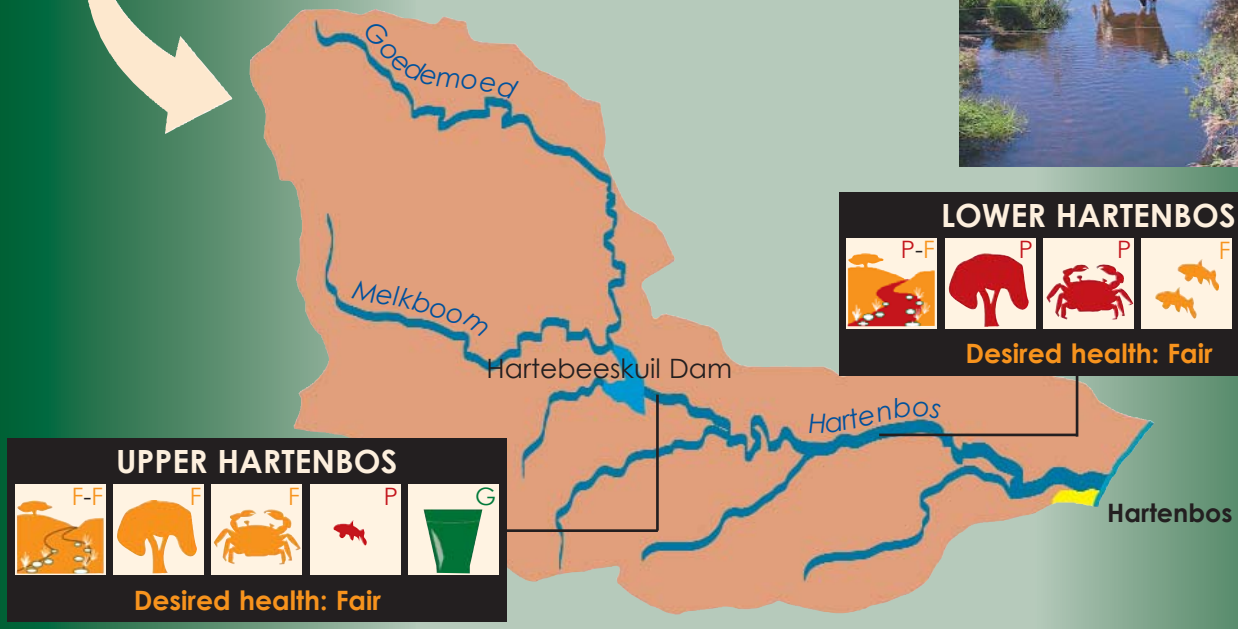


The Hartenbos River Catchment

The Hartenbos River is approximately 34km long, and rises in the foothills of the Outeniqua mountains. The lower reaches of the river drain low relief hills and flow through a low-lying area with an extensive flood plain of 207ha where channel migration has occurred in the past. The river then meanders across the flood plain and flows between dune ridges at the mouth to discharge into the Indian Ocean. The upper reaches of the river lack a well-defined channel, while the lower reaches form the Hartenbos estuary.

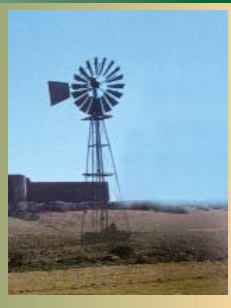
The upper reaches of the Hartenbos catchment are used mostly for grain and wheat farming, while the lower reaches are used for grazing for cattle, sheep and ostrich farming. Urban developments occur around the Hartenbos estuary.





Groundwater

There is a direct link between groundwater and surface water. Groundwater provides important baseflows in rivers and contributes to water levels in the lower reaches. The current focus on groundwater as a potential water resource makes it essential that proposals for water use in the Hartenbos River are properly evaluated in environmental impact assessments (EIA). The NEMA requires an EIA before bulk water supply from groundwater sources takes place.



Major Impacts

Sand Mining

Sand mining for the building trade takes place in the lower reaches of the Hartenbos River. River habitats are disturbed and the river bed becomes unstable and covered in silt, resulting in a loss of species diversity.

A large permanent pool has developed in the river where considerable quantities of sand have been removed from deeper layers. Although rooted macrophytes and marginal vegetation habitats have developed in the pools, the absence of stony runs has reduced the overall habitat diversity and variety of species at this site.

Management Actions

- **Improve farming land-use practices to reduce salinity and turbidity impacts on the river**
- **Rehabilitate in-stream and riparian habitats after sand mining has taken place**
- **Restore flow below Hartebeeskuil Dam**

Dams

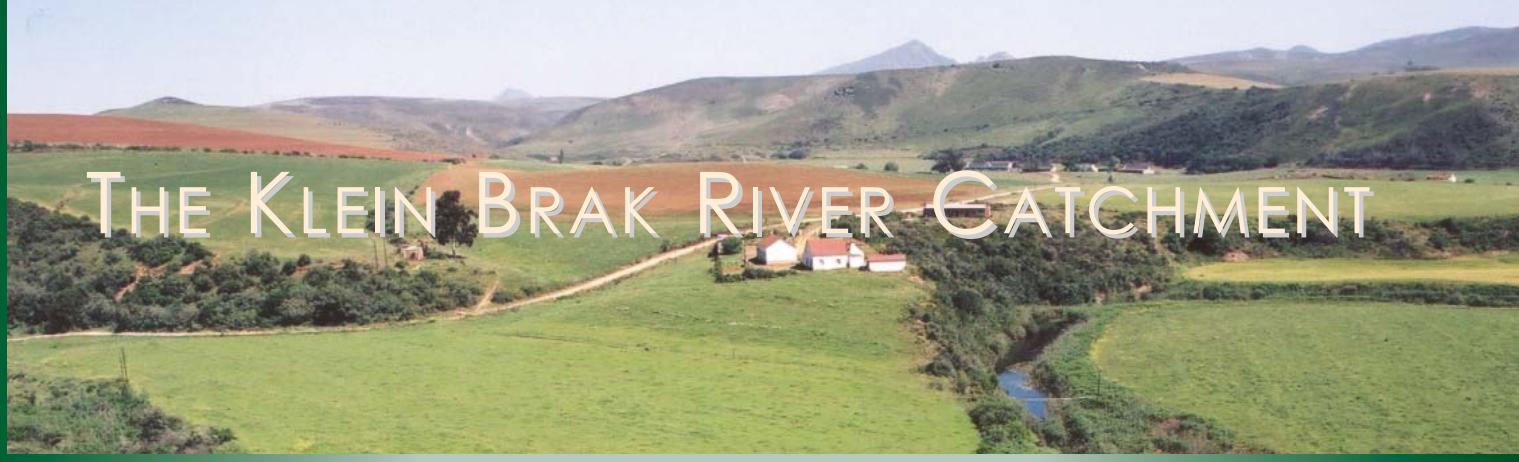
The Hartebeeskuil Dam (right) is situated approximately 12km from the mouth of the Hartenbos River. Unfortunately, the dam contains semi-saline (brack) water from underlying geological formations. The water is too saline for significant use and is used for the irrigation of hardy crops only. The dam is now primarily used for recreation.

Water flow below the dam has been drastically reduced because there is no mechanism to release water. The area downstream of the dam is, therefore, largely modified with an increased loss of natural habitat, biota and ecosystem functions.

Water Quality - Salinity & Turbidity

The geology of the catchment determines the natural **salinity** in rivers. Human activities in river catchments increase salinity. Tolerances to salinity changes are species specific and are likely to alter community composition over time.

Land-use practices such as farming, construction and sand mining in or near rivers increase the **turbidity** or suspended solids in rivers. Large increases in turbidity may have serious consequences for aquatic biota as light penetration and water temperature are reduced, which reduces food availability. Deposition of sediments in rivers reduces habitat quality and diversity.

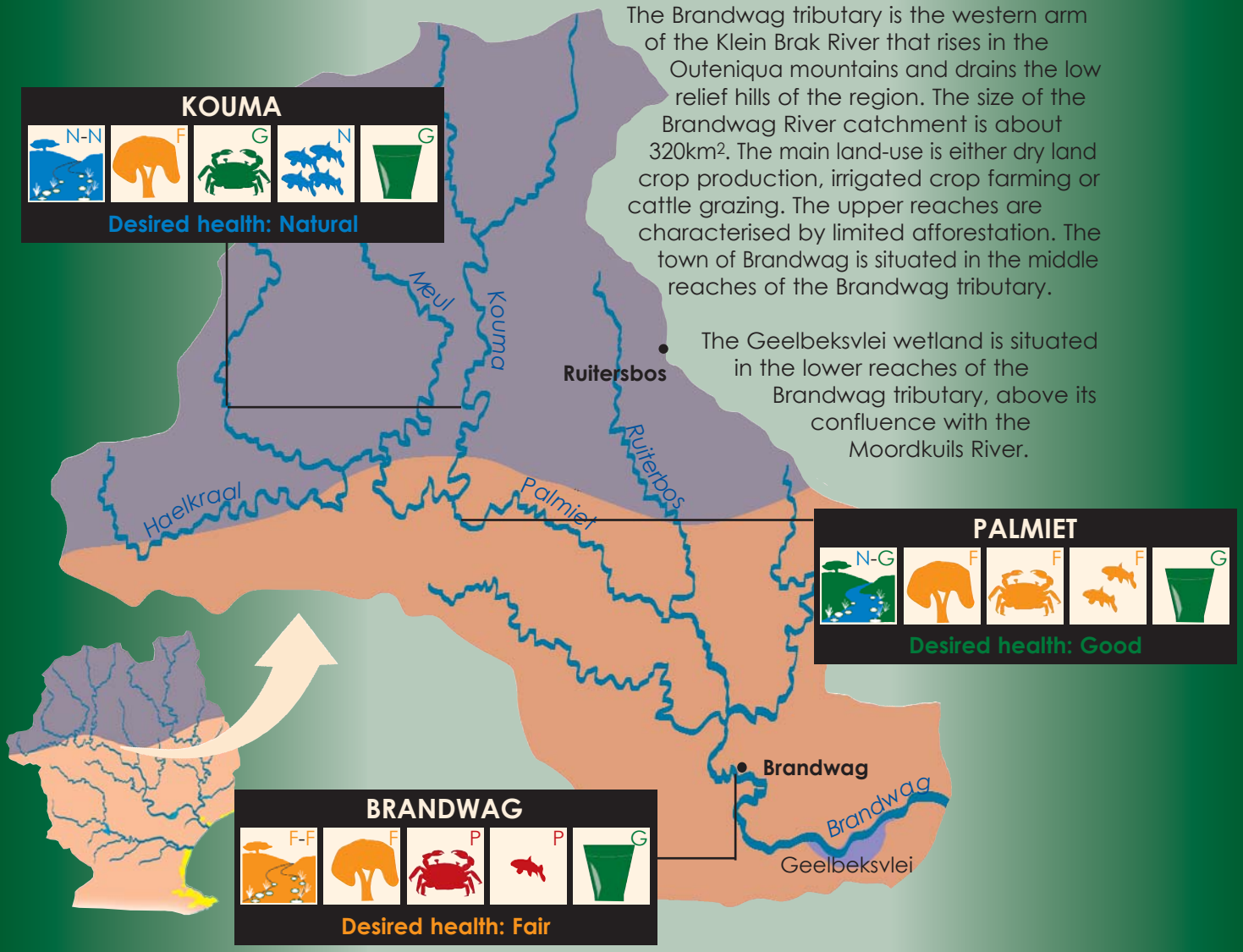


The Klein Brak River Catchment

Brandwag Tributary

The Brandwag tributary is the western arm of the Klein Brak River that rises in the Outeniqua mountains and drains the low relief hills of the region. The size of the Brandwag River catchment is about 320km^2. The main land-use is either dry land crop production, irrigated crop farming or cattle grazing. The upper reaches are characterised by limited afforestation. The town of Brandwag is situated in the middle reaches of the Brandwag tributary.

The Geelbeksvlei wetland is situated in the lower reaches of the Brandwag tributary, above its confluence with the Moordkuils River.



What Are Wetlands?

Wetlands result from periodic flooding of land for varying durations. They have characteristic vegetation, soils and fauna and include mountain seeps, midland marshes, swamp forests, stream bank wetlands, estuaries or open coasts. Wetlands are valuable for natural water purification, flood control, water storage, flow regulation, soil erosion protection, as recreational areas or as habitat for aquatic life.

The conservation of the remaining wetlands is becoming increasingly important, because more than half of South Africa's wetlands have already disappeared. The Geelbeksvlei (210ha) is a floodplain wetland of regional significance.


pesticide spraying


farming on river bank


water hyacinth


smallmouth bass

photo: WCNCB

Major Impacts

Farming

Farming practices on the banks of the river often damage the riparian vegetation and result in sedimentation of the river. Overgrazing also leads to soil degradation, soil erosion and consequent loss of topsoil. Excessive nutrient loads from farming activities (e.g. fertilisers) lead to eutrophication in the river (see box below).

Alien Plant & Fish Infestation

The proliferation of introduced alien vegetation such as water hyacinth is the result of elevated nutrient levels in the river. These plants clog the water surface, deplete oxygen and smother indigenous plants and biota that live in the river, foster mosquitoes and restrict water flow.

The Working for Water Programme has done considerable work in this area by clearing alien trees and improving river flows.

The loss of indigenous fish species (redfin minnow, Cape galaxias and Cape kurper), is largely due to the introduction of predatory alien fish (e.g. smallmouth bass).

Management Actions

- **Improve farming practices, specifically related to the protection of the indigenous riparian vegetation and the correct use of fertilisers and appropriate pesticides - healthy riparian zones trap nutrients before these enter the river**
- **Eradicate invasive alien plants (see Alien fauna p 21)**
- **Establish a conservancy in the Kouma River to protect endemic fish species**


redfin minnow

Water Quality - Nutrient Enrichment

Nutrients are required for plant growth and production. Eutrophication is the result of high nutrient concentrations (nitrogen and phosphorus) which cause excessive plant growth in the water. The prolific growth of algae and other plants can have significant impacts on the structure and functioning of biota in the river. Algal growth is often seen where human influence on a river is prevalent.

Nutrient sources from human activities include wastewater discharges (industrial or sewage) or agriculture (livestock feedlots or the use of fertilisers).

The Klein Brak River Catchment

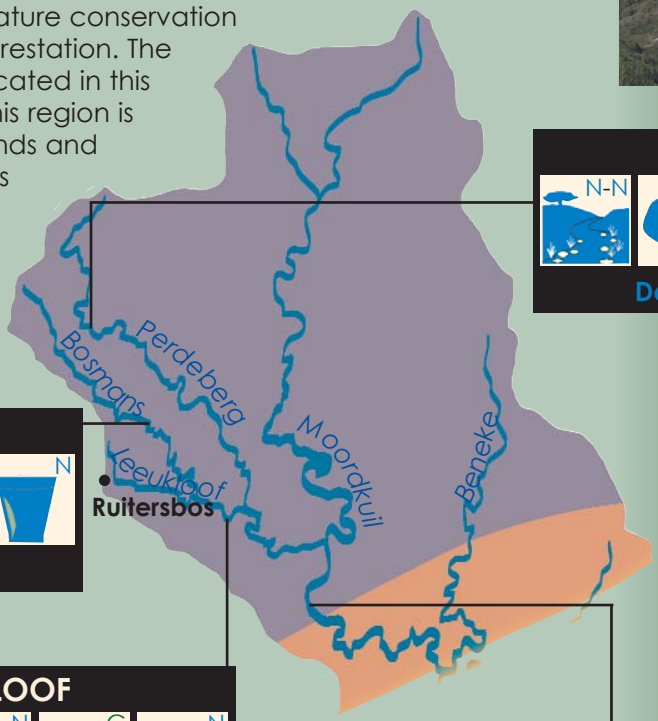
Moordkuil Tributary: Upper Reaches

The Moordkuil River, a tributary of the Klein Brak River, has a catchment size of about 225km². It originates east of the Robinson Pass in the Outeniqua mountains and drains the high relief (steep valleys) of these mountains (right).

The upper reaches of the Moordkuil tributaries fall within the Cape Fold Mountains ecoregion and are characterised by Table Mountain Sandstone and granite.

The area is dominated by nature conservation areas, interspersed with afforestation. The Ruitersbos forest station is located in this area. The lower portion of this region is dominated by cultivated lands and livestock farming (e.g. horses and cattle).

Alien vegetation infestation is prevalent in the upper reaches.



PERDEBERG

Desired health: Natural

BOSMANS

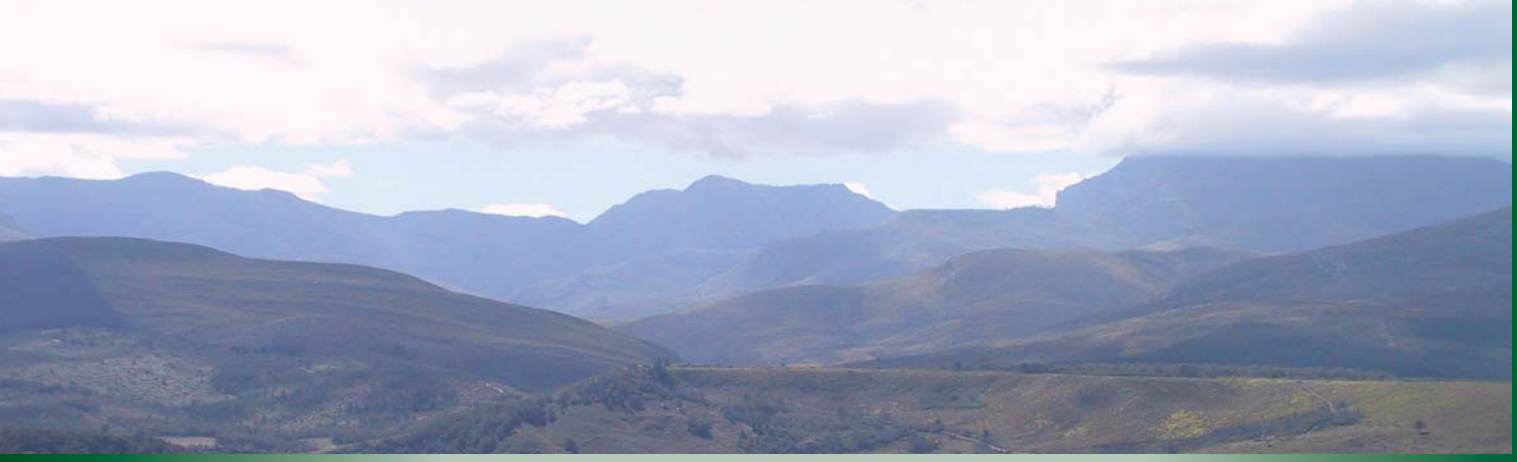
Desired health: Natural

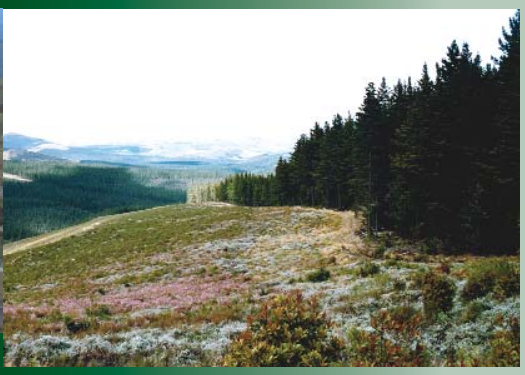
LEEUKLOOF

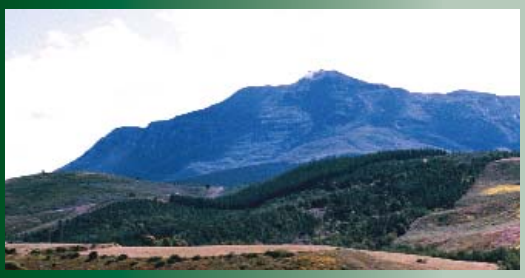
Desired health: Natural

HAMELKOP

Desired health: Natural







Major Impacts

The upper reaches of the Moordkuil catchment are mainly impacted by **forestry** and **invasion by alien vegetation**. Alien plants and pine plantations are very close to the river's edge and impair the functioning of the riparian zone.

Forestry

Commercial forestry reduces water flow and acts as a source of invasive alien plants and foreign leaf-litter in the river.

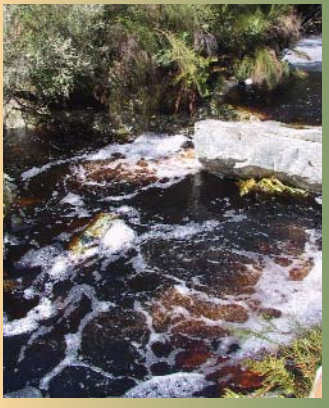
Forestry in the Moordkuil catchment was established about 80 years ago, with the main type of forestry being the alien cluster pine, *Pinus pinaster*.

Management Actions

- **Clear and control invasive alien vegetation in the upper reaches of the river, as this is a source of seeds for the lower reaches**
- **Rehabilitate forestry areas back to natural vegetation where feasible or desirable**

Alien Vegetation

Alien vegetation infestation results from land-use disturbances to natural vegetation (i.e. forestry and agriculture). The presence of pine plantations and other alien vegetation (e.g. black wattle) in the upper reaches of the Moordkuil River impacts negatively on the riparian habitat. See page 23 for more information on alien vegetation.



The pH in the Moordkuil Tributaries

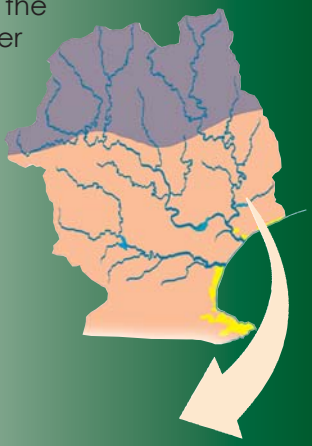
The natural pH of the rivers draining the fynbos-covered Table Mountain Sandstone formations is acidic and generally ranges between 4 and 6. This is typical of the black water tributaries in the area. Lower downstream, the Moordkuil River enters shale formations that increase the pH and conductivity of the water. This may lead to a change in water colour. The biota associated with the different water types are different as well.

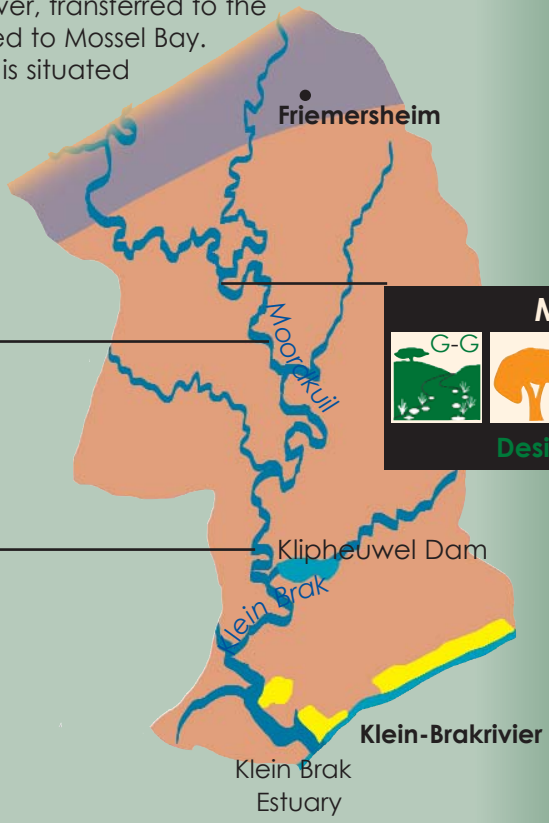
The Klein Brak River Catchment

Moordkuil Tributary: Lower Reaches

The lower reaches of the Moordkuil tributary lie within the Southern Coastal Belt ecoregion. The Moordkuil River joins the Brandwag River about 3km from the coast to form a large alluvial plain, the Klein Brak River. The Klein Brak River is estuarine, has a permanent tidal exchange zone of about 6km and discharges into the Indian Ocean. This region is typically characterised by a more moderate relief covered by shrubland and fynbos.

Activities within this region include crop production and game and cattle farming. Water is abstracted from the lower reaches of the Moordkuils river, transferred to the Klipheuwel Dam and supplied to Mossel Bay. The town of Klein-Brakrivier is situated at the Klein Brak estuary.





BOTLIERSKOP

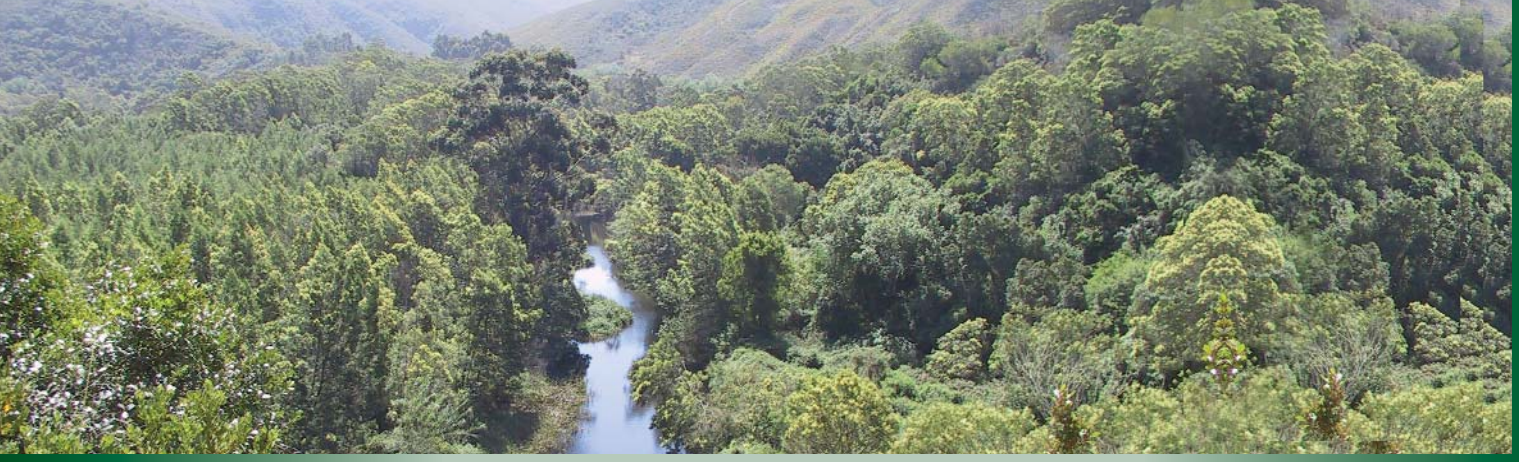
Desired health: Good

MOORDKUYL

Desired health: Good

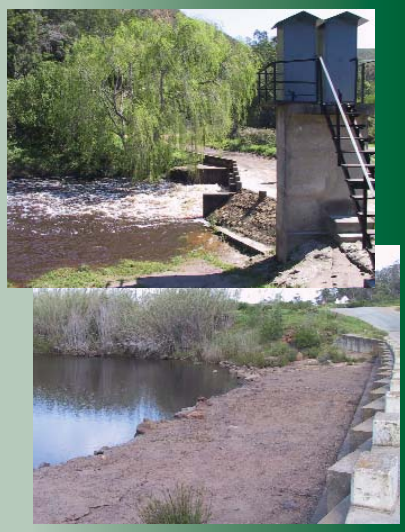
RHEEBOKSFONTEIN

Desired health: Good



Major Impacts

Low Water Bridge and Gauging Weir



Certain fish (e.g. mullet and eels) and invertebrates (e.g. crabs) migrate between the river and the sea to complete their life-cycle. Bridges, dams and gauging weirs inhibit the movement and migration of these fish and invertebrates, causing them to accumulate and make them susceptible to predation and poaching.

A road bridge and gauging weir creates a physical boundary at the upper reaches of the Klein Brak estuary. Although the low water bridge and gauging weir have a very localised impact on the habitat suitability for biota, these barriers impacts on the water flow, tidal variation and the migration of fish and invertebrates within the estuary.

Alien Fauna and Flora

The invasion of alien vegetation is severe in places with black wattle (see p 23) replacing the indigenous forest and fynbos. They grow abundantly and form dense impenetrable thickets along the river.

Alien fish prey on the indigenous fish in the lower reaches of the river. The Klein Brak River has three indigenous fish species (see p 21). These are thought to an impartant role in the food chain. The disappearance of all three species from several sites is a concern.

Farming Activities

Activities along the river such as cattle grazing and trampling have a localised impact on the habitat suitability for biota and water quality.

Management Actions

- **Construct or alter physical structures, such as roads, bridges and weirs, in such a way that they allow migration of fish species, unrestricted river flow and tidal interaction**
- **Clear alien vegetation from the riparian zone. No alien fish species should be introduced into farm dams or rivers**
- **Keep livestock away from rivers where possible and provide alternative water supply**

Estuaries

What are Estuaries?

Estuaries are unique habitats where rivers interact with the sea. In estuaries, the degree to which rivers interact with the sea, varyies. The opening and closing of estuaries are often seasonal events, and most river mouths and estuaries on the South African coast close for a part of the year.

Estuaries provide many goods and services to society. Examples include:

- Food and bait collection
- Nurseries and refugia for birds, fish and crustaceans
- Tourism and recreation
- Cultural and spiritual activities
- Materials for craftwork

Estuaries are directly influenced by human activities that occur within the catchment, such as sewage discharges and over-exploitation of fish, but also indirectly through activities taking place in the catchment. Storage and abstraction of water within the catchment reduce the amount of freshwater that reaches the estuary, thereby increasing the marine influence on the estuary. Waste discharge and sedimentation from erosion in the catchment also has a major impact on the estuaries.

Importance of the Hartenbos and Klein Brak Estuaries

Hartenbos Estuary

- High conservation importance in terms of species diversity
- Under threat from urban development
- The estuary mouth is predominantly closed and is vulnerable to impacts (e.g. farming, wastewater discharge)
- Discharge of treated wastewater (nutrient rich freshwater) reduces the salinity in the estuary. This, together with a reduction in open mouth conditions, leads to prolific growth of algae (below right)and loss of species diversity.

Klein Brak Estuary

- High conservation importance in terms of species diversity
- Deposition of marine sediments in the estuary is increasing as a result of reduced riverine inflows
- The region surrounding the estuary is not highly developed
- Less vulnerable to impact from human activities due to open mouth conditions. The mouth only closed on three occasions during the 20th century.
- Flood events are important in flushing out sediments. The probability of a major flood event is approximately 1 in 12 years.

Management of Estuaries

- **Optimise the benefits offered by an estuary by managing human exploitation of the estuary and its catchment. For example, the decreasing flows of the Klein Brak River should be managed and not so much the estuary itself (dredging out marine sediment). The Hartenbos River catchment, however, has a low gradient and the estuary is largely artificial as a result of the treated wastewater discharges. It is unlikely that floods would remove the accumulated sediments at the mouth of the estuary and artificial means of removal are needed.**

- **Investigate the possible impact of iron oxide rich sludge, from a water purification system formerly spilled over a period of ten years, on a sand bank supporting prawns in the Klein Brak River. The sludge is now pumped to the sewage treatment plant near Hartenbos.**

- **Manage estuaries through interaction between managers and users.**

Fauna

Endemic & Other Fauna of Interest


Photo: M Gibbons

Rivers and riparian vegetation provide habitat for many plants and animals and allow for their migration. Examples of animals that migrate along the Hartenbos and Klein Brak rivers are vervet monkeys (left), southern cape bushbuck, cape clawless otter, water mongoose, bushpig and blue duiker.

The blue crane (*Anthropoides paradisea*), a red data species, is South Africa's national bird. It is endemic to Southern Africa and occurs along the southern coastal plain. The habitat and food supply of the blue crane is slowly disappearing due to forestry and farming activities in the area. Blue cranes are also accidently poisoned, e.g. by farmers trying to protect crops.

In recent years, there has been a significant shift towards game farming in the region because of the growing tourist trade. (About nine game farms have been established during the past ten years.) Game farming is a more viable and environmentally friendly farming activity for the area.


dragonfly


dobsonfly

Invertebrates

Many invertebrates spend part of their life-cycle in water and they fulfil several important function in rivers:

- The self-purification of rivers (invertebrates scrub and clean the surfaces of leaves and stones and filter the river water)
- Invertebrates are important in the food chain (plants, algae and bacteria absorb nutrients in the river, they in turn are consumed by invertebrates that are a food source for larger insects, fish and birds).

Frogs and Toads


arum lily frog


raucous toad

Photos: A Channing

A variety of frog species occur in both the natural and modified habitats of the Klein Brak and Hartenbos rivers and catchments. The fynbos biome covers 3% of southern Africa but supports 28% of its frog species, most of them endemic.

Frogs are important indicator species for freshwater ecosystems because of their sensitivity to habitat degradation and should be monitored regularly.

Frog populations worldwide have been decimated, especially over the past twenty years due to deforestation, habitat loss and pollution. Desiccation and susceptibility to pollutants are critical stresses experienced by frogs because of their dual terrestrial and aquatic lifestyle and permeable skin.


ghostfrog tadpole

Common amphibian species found in these catchments include raucous toad, painted reed frog, arum lilly frog and common river frog. The southern ghost frog is seldom seen and frequents fast-flowing perennial streams in forested mountain habitat. The tadpole is equipped with a sucker for attaching to rocks.


Cape kurper


Cape galaxias


Cape Kurper

Eastern Cape redfin

Fish

Klein Brak River

The Klein Brak River has natural freshwater fish fauna that includes:
- Cape galaxias (*Galaxias zebratus)*
- Cape kurper (*Sandelia capensis)*
- Eastern Cape redfin (*Pseudobarbus afer)*

These fish have a wider distribution, are relatively common in the southern Cape area, and are restricted to the Cape Floral Kingdom.

The indigenous freshwater fishes in the Klein Brak River are now rare. The presence of the predatory smallmouth bass (see Alien Fish Species below) in the Klein Brak River contributed to the Cape galaxias and Eastern Cape redfin being listed as threatened species. In rivers where alien fish are absent, large numbers of indigenous fish are found .


freshwater mullet

Estuarine Fish Entering the Klein Brak River

Several estuarine fish species were recorded in the fresh-water reaches of the Klein Brak River, including:
- Cape moony (*Monodactylus falciformis*)
- Freshwater mullet (*Myxus capensis*)
- Cape silverside (*Atherina breviceps*)


Cape moony


foto: WCNCB

Alien Fish Species

Apart from bass, (a North American fish species introduced to our rivers), several other alien fish have been introduced into the Klein Brak River because of their angling or food value, e.g. sharptooth catfish (bottom left), carp (left) and Mozambique tilapia, or as a fodder fish for bass, e.g. banded tilapia.

Alien fish have major detrimental effects on the ecological health of the Klein Brak River. They prey on, or compete with, indigenous fish for food thus reducing species diversity and disrupting the ecological balance, with impacts further down the food chain. Carp are bottom feeders, uprooting plants and keeping the water turbid (muddy) by preventing siltation. Water quality deteriorates because of these feeding habits.

Flora

Indigenous Flora

Fynbos and Renosterveld

Mountain fynbos and renosterbos dominates. The flora include: proteas, ericas, restios, coral aloe (*Aloe striata*), bitter aalwyn (*Aloe ferox*), wild iris, geranium, pelargonium, wild sage (*Salvia aurea*), boegoe, renosterbos (*Elytropappus rhinocerotis*)

Forest

Forest patches are common in several river valleys , particularly in the upper catchment. Trees include: wild pomegranate (*Burchellia bulbalina*), *Acacia karoo,* Outeniqua yellowwood (*Podocarpus falcatus*), keurboom (*Virgilia divaricata*), Cape chestnut (*Calodendrum capense*), white milkwood (*Sideroxylon inerme*)

Estuarine

Salicornia meyeriana, *Sarcocornia perennis*

Outeniqua Yellowwood and Cape Chestnut

Outeniqua yellowwood (left) and Cape chestnut trees are indigenous to the South Coast forest. The yellowwood has a lifespan of up to 2 000 years and reaches a height of 50m, while the chestnut trees reach a height of 16m.

The trees and forests are threatened by cultivation, fires, alien afforestation and crafting of furniture. The value of the forests is now appreciated and they are protected by law.

Photos: F Weitz

Bitter Aalwyn

(Aloe ferox)

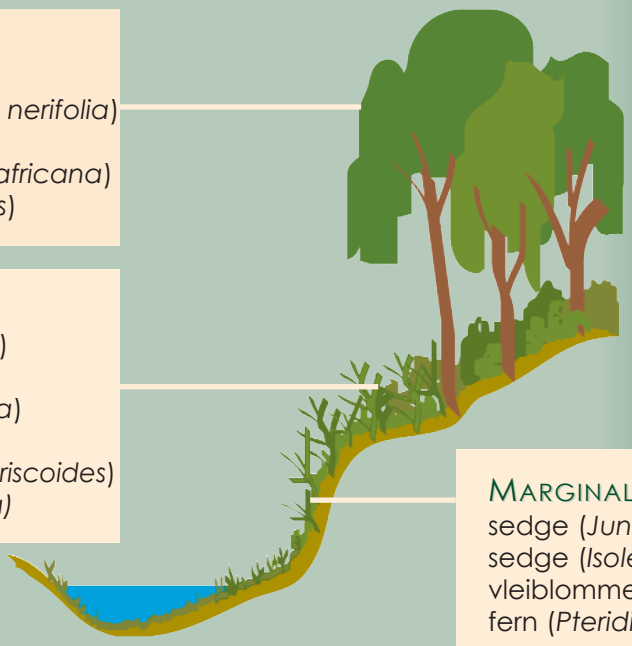
These succulent plants (above) are conspicuous in the mountains and coastal belt and occur from Swellendam to Natal. They can grow to over 4m in height and are heavily spined. Their rich yellow sap is collected and used commercially in the preparation of various health and cosmetic products.

Riparian Trees

Cape holly (*Ilex mitis*)
waterwhite alder (*Brachylaena nerifolia*)
red currant (*Rhus chirendensis*)
Cape stock-rose (*Sparmannia africana*)
dew-berry (*Grewia occidentalis*)

Riparian Shrubs

lightning bush (*Clutia pulchella*)
gonnabos (*Passerina falcatus*)
fountain bush (*Psoralea pinnata*)
Phylica sp.
mountain daisy (*Osmitopsis asteriscoides*)
wildewingerd*(Cliffortia odorata)*



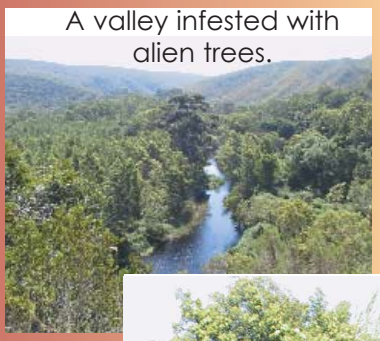
Marginal Vegetation

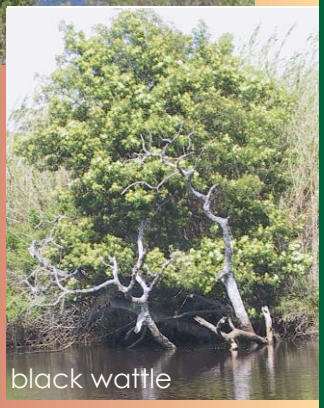
sedge (*Juncus iomatophyllus*)
sedge (*Isolepis prolifer*)
vleiblommetjie (*Persicaria acuminata*)
fern (*Pteridium aquilinum*)

Alien Flora


eucalypt

Invading alien plants are one of the largest threats to plant and animal species diversity and have become established in over 10 million hectares of our land. The cost of controlling alien plants in South Africa is estimated at R600 million a year over 20 years. Alien plants waste 7% of our water resources, reduce our ability to farm, intensify flooding and fires; cause erosion, destroy rivers and cause siltation of dams and estuaries; lower water quality and leed to mass extinction of indigenous plants and animals.


A valley infested with alien trees.


black wattle

Alien Plants in the Hartenbos and Klein Brak Catchments

bramble (*Rubus sp.*)
lantana (*Lantana camara*)
rooikrans (*Acacia cyclops*)
port jackson (*Acacia saligna*)
black wattle (*Acacia mearnsii*)
water hyacinth (*Eichhornia crassipes*)
cluster pine (*Pinus pinaster*)
sweet hakea (*Hakea suaveolens*)
long-leafed wattle (*Acacia longifolia*)
castor-oil plant (*Ricinus communis*)
poplars (*Populus spp.*)
gum trees (*Eucalyptus spp.*)

Black wattle

The black wattle originates from south eastern Australia. It was introduced into Natal for shelter and firewood and, since 1880, has been commercially cultivated for its bark. This tree grows some 20m tall and produces strong scented pale yellow flowers (Sept - Oct). They compete with and replace indigenous vegetation; replace grass and reduce the carrying capacity of land.


hyacinth


poplar

Poplars

Poplars originate from the British Isles, central and northern France and Western Europe. They threaten indigenous plant comunities, invade river banks, obstruct access to water and significantly increase water loss.


lantana

Lantana

Lantana originates from the West Indies and South America, and was first introduced (via Europe) to the Cape in 1858. The seeds are spread by fruit-eating birds. Lantana is found along forest margins, is poisonous and can cause stomach and intestinal irritations, muscular weakness, frequent urination and blood-stained faeces. Humans, particularly children, have died from neuro-circulatory collapse. These plants should be removed by landowners and land managers.

Management Issues

Management Actions

The needs and priorities for management intervention can be determined once we know what the present and the desired health of a river is. **Management action** refers to what is being done, whether current actions are effective and what should be done further to improve river health. Management actions may include policies, national and local management strategies or specific initiatives regarding the management of natural resources in general and aquatic ecosystems in particular.

How to Get Involved

New legislation 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 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. The active co-operation of water users is of the utmost importance in maintaining a healthy environment.

How can we Protect and Conserve our Indigenous Fauna and Flora?

- Remove alien plants and trees along river banks in co-operation with the Western Cape Nature Conservation Board (WCNCB)
- Join a volunteer invasive alien plant clearing or hack group and encourage others to become involved (e.g. local authorities, agricultural unions, schools, communities)
- Buy alien plant products (firewood, charcoal, crafts, furniture, toys, building material, mulch)
- Inform the authorities about the location of invasive alien plants and fish
- Do not import or buy alien plants and fish
- Do not stock rivers with alien fish
- Landowners should protect suitable areas for indigenous fish conservation, under the guidance of the WCNCB

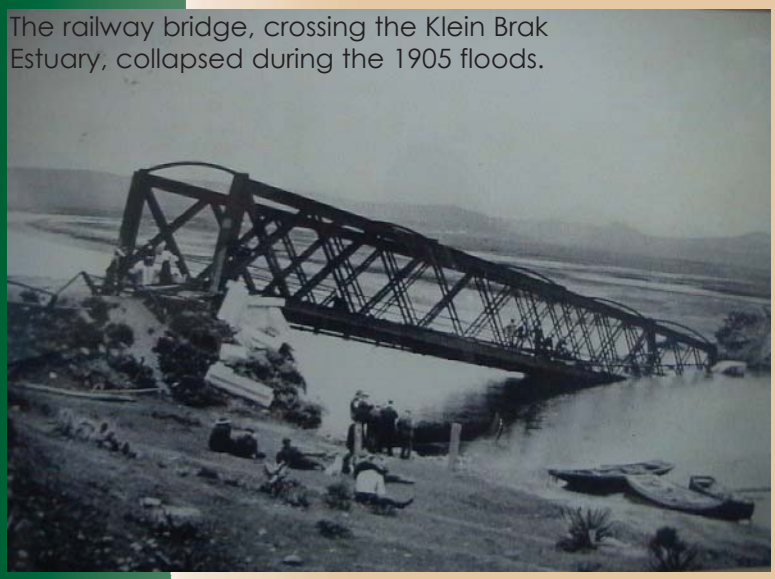
What can we do to Protect our Rivers?

- Reduce water consumption and do not waste water - water is precious
- Improve agricultural practices, prevent erosion and reduce fertiliser application
- Avoid straightening river channels and smoothing riverbeds since this promotes erosion. Meanders help to reduce water flow speed, but can increase flood risk and damage
- Remove chopped down alien vegetation material from riverbeds and river-banks as this material could clog up the river downstream
- Do not dump litter, garbage, pesticides or building rubble on river banks or in rivers
- Plan activities within the river so that they cause minimal disturbance to the river. Request permission to modify river banks, sink boreholes in riparian zones and build dams on rivers.
- Consult local offices at:
  the Western Cape Nature Conservation Board (Tel: 044-874 2160) and the Department of Water Affairs and Forestry (Tel: 021-950 7100, Regional Office: Bellville) for guidance regarding river and catchment issues.
  They are there to help you.

Historical Background

Historical Developments in the Klein Brak River Catchment

The exact origin of the name of the Moordkuil tributary is not known, although its name is derived from the Khoi word, Conna, which means "to strike down" or "to murder". The Moordkuil River bore this Khoi name when Ensign Beutler crossed the river in 1752 during his expedition to map the region for Governor Ryk Tulbagh. During this time, the first farmers had already settled along the lower reaches of the river, at Klipheuwel and Rheeboksfontein.



The railway bridge, crossing the Klein Brak Estuary, collapsed during the 1905 floods.

Irrigation of vineyards and orchards has occured along the lower reaches of the Klein Brak River since the 18th century.

Between 1899 and 1901, Donald Robertson of Klipheuwel constructed a canal about 14km long to irrigate about 300ha of his property along the western bank with water from the Moordkuil River. In 1901, the Meyers of Rooiheuwel and Causeway installed a pump to irrigate their land on the eastern side of the lower Moordkuil River. This area was later acquired by the Robertsons and was expanded to the present irrigated area, which exceeds 200ha. The Brink family developed small irrigation areas on Plaatjieskraal and Botlierskop to a maximum area of about 45ha in the 1960's. These areas have since fallen into disuse.The introduction of electricity and PVC piping in the area caused an accelerated riparian development after 1970. In 1979, the then Department of Water Affairs constructed a pumping station on the Moordkuil River and Klipheuwel Dam, an off-channel storage facility adjacent to the river to supplement the Municipality of Mossel Bay's water supply. The operation of the Klipheuwel Dam and pump has an enormous impact on the dynamics of the Moordkuil River and the Klein Brak estuary.

Glossary & Further Reading

Glossary

Alien species Fauna and flora introduced intentionally or by accident from other countries. Not all alien species are invasive.

Biodiversity The structure, composition, functions of living organisms and the ecological complexes of habitats in which they occur.

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

Desired health 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.

Fauna The collective term for animals living in a particular area.

Flora The collective term for plants growing in a particular area.

Indigenous species Fauna and flora occurring naturally in an area.

Instream refers to "within the river channel"

Marginal vegetation refers to plants growing at the edge of the river.

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

Red data species Species of plants and animals that are under threat. The red data categorisation of species indicates their conservation status (extinct, endangered, vulnerable and rare).

Riparian habitat refers to the habitat on the river bank

Riparian zone 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.

spp. Abbreviation for a grouping of species (plural). Species (sp.) (singular) refers to the unit of biological classification and diversity.

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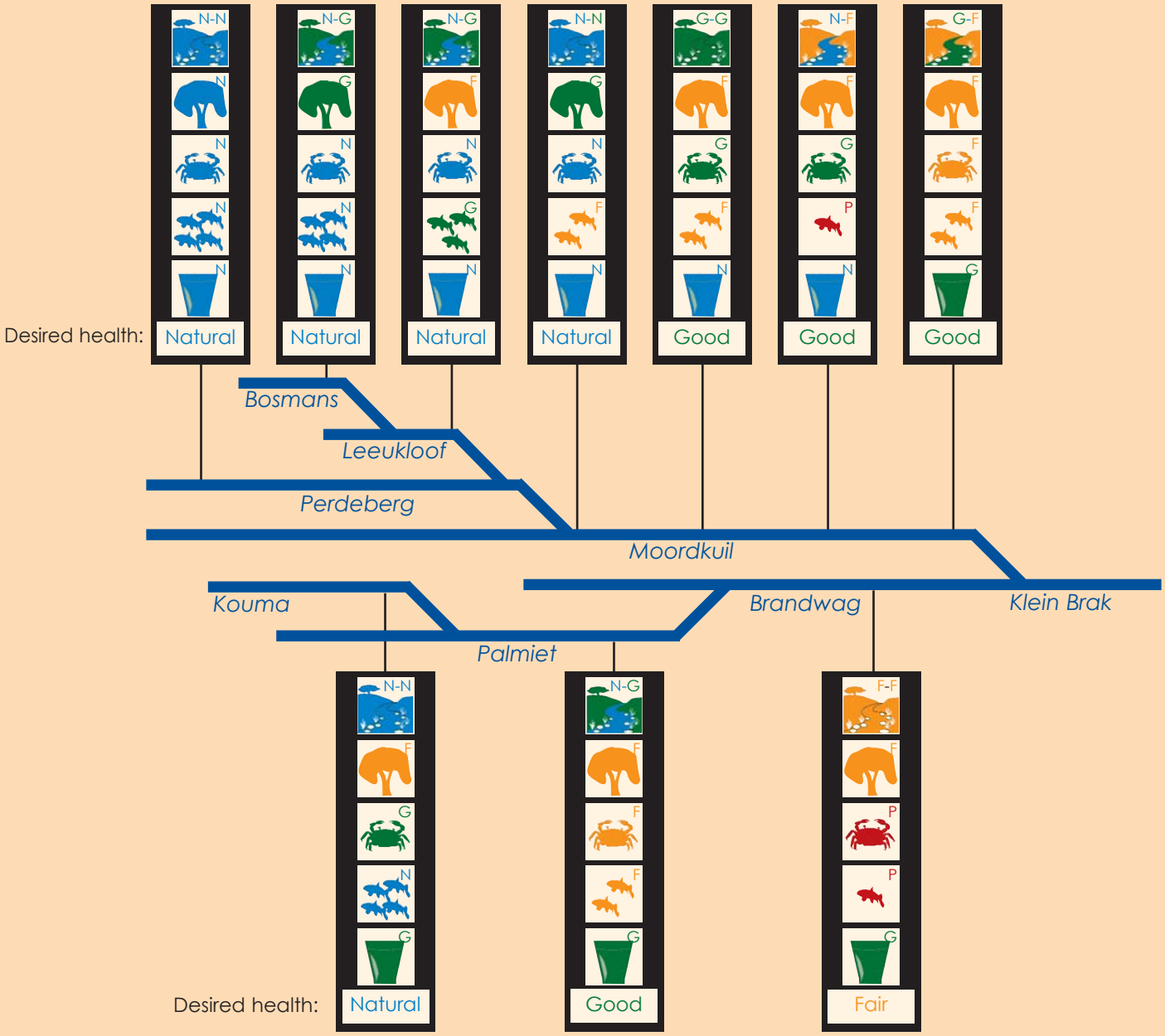
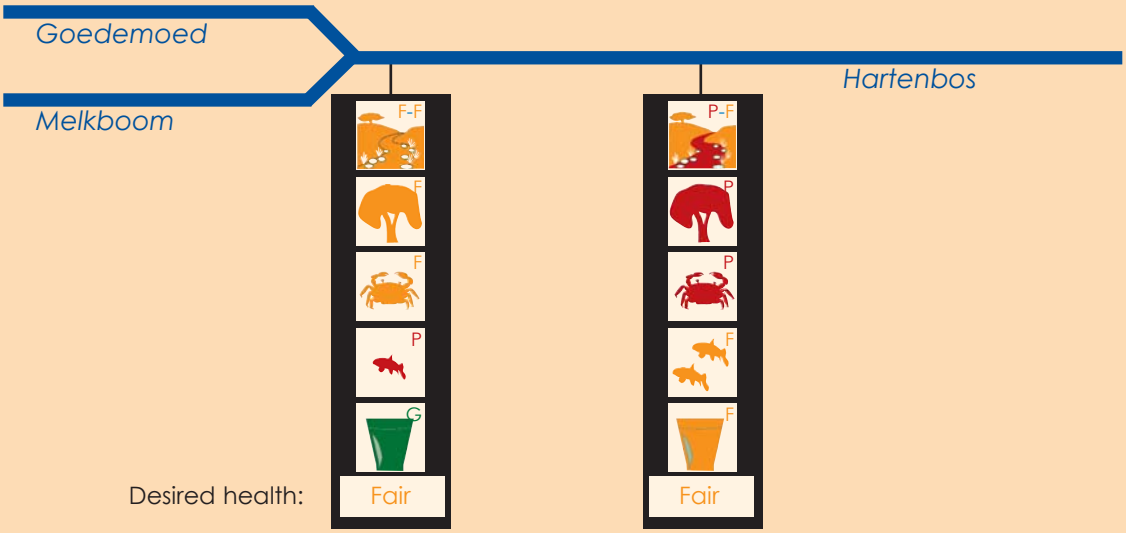
Summary

Klein Brak River

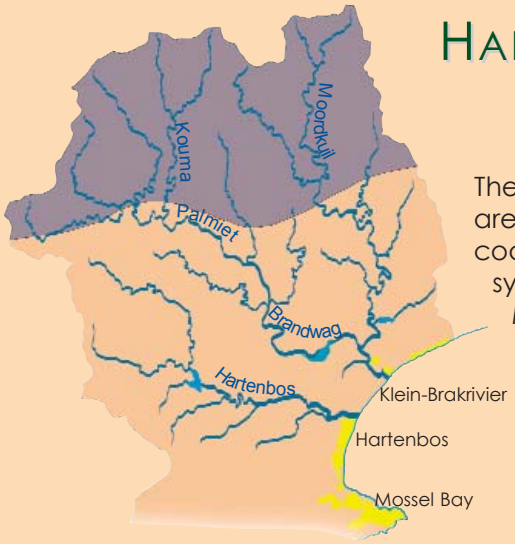


Hartenbos River



Hartenbos and Klein Brak

River Systems - 2003



The Hartenbos and Klein Brak rivers are situated on the Cape south coast. They are typical coastal river systems draining the Table Mountain Sandstone formations of the Cape Fold Mountains.

Land-use in these catchments consists of nature conservation, plantation forestry, grazing, limited agriculture, game farming and small rural settlements. Klein-Brakrivier and Hartenbos are the only relatively large towns in the area. Other urban areas in the catchment are Ruitersbos (Forestry Station), Friemersheim and Brandwag.

Moordkuil River

Habitat and water quality in the Moordkuil River and its tributaries are in a good to natural state. The major impacts on river health are the presence of alien fish (smallmouth bass) and alien vegetation (black wattle) within the riparian zone.

Kouma River

Endemic fish (redfin minnow) are still found in the Kouma River. As such, the Kouma River is considered to be an important tributary of the Klein Brak River and to have a high conservation status. However, alien vegetation found along the river banks have reduced the overall health of the river system.

Palmiet and Brandwag Rivers

Water quality and habitat integrity within the rivers deteriorates downstream as a result of development (farming and housing). The presence of alien fish (carp) and vegetation (water hyacinth) impairs river health.

Hartenbos River

Flow regime and habitat are severely altered in this system. This is mainly as a result of the Hartebeeskuil Dam which does not allow flow releases. In addition, sand mining operations have resulted in a decrease in habitat diversity with a consequent loss of species diversity in the river.

http://www.csir.co.za/rhp/

Department of Water Affairs and Forestry
Department of Environmental Affairs and Tourism

Water Research Commission

WESTERN CAPE NATURE CONSERVATION BOARD

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ISIXEKO SASEKAPA
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Mosselbaai Munisipaliteit
Mossel Bay Municipality
Umasipala Mossel Bayi

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