This report is based on the findings of river surveys that were conducted on the uMngeni, uMlazi, uMhlatuzana and uMbilo rivers between 1992 and 2002 as part of the implementation of the River Health Programme in KwaZulu-Natal.

Department of Water Affairs and Forestry
Department of Environmental Affairs and Tourism
Water Research Commission
Umgeni Water
eThekwini Municipality
CSIR Environment
University of Natal

This report is based on data that has been accumulated by several organisations over a number of years. For the full list of contributors, refer to the back of this report.

This report has been reviewed by the Water Research Commission and approved for publication. Approval does not indicate that the contents necessarily reflect the views and policies of the WRC, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Suggested citation:
WRC report no.TT 200/02
Water Research Commission
Pretoria
ISBN No:1 86845 899 7

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

INTRODUCTION
Why know about river health?
The River Health Programme
Measuring river health
River health classification
State-of-Rivers (SoR) reporting

UMNGENI AND NEIGHBOURING CATCHMENT ECOREGIONS

OVERVIEW OF THE STUDY AREA

HOW TO READ THIS REPORT

MIDMAR RESOURCE UNIT

ALBERT FALLS RESOURCE UNIT

UPPER UMSUNDUZE RESOURCE UNIT

PIETERMARITZBURG RESOURCE UNIT

INANDA RESOURCE UNIT

LOWER UMGENI RESOURCE UNIT

UMLAZI RESOURCE UNIT

SUMMARY DIAGRAM OF STATE OF RIVERS

DAMS AND URBAN RIVERS

FISH OF THE UMGENI RIVER

A HISTORICAL DESCRIPTION OF THE UMGENI RIVER

HISTORICAL REFERENCES

CONTRIBUTORS
INTRODUCTION

Why do we need this report? Information about river health tells us about the range and quality of goods and services that a particular state of the river system can deliver. It also tells us about the sorts of impacts that a river system can absorb. This information helps us to manage our rivers because it ensures that we balance the needs of the river health with other factors that are important in the development of the river system.

Why be involved? Many aspects of our survival and economic growth are critically affected directly or indirectly by the health of our rivers and by the decisions that change their ability to deliver a range of goods and services. The Department of Water Affairs and Forestry (DWAF) is the custodian of our country’s water resources. This responsibility includes the protection of the ability of river ecosystems to continue to provide goods and services, and in doing so, to protect the use and associated benefits for current and future generations. As a result, DWAF initiated the River Health Programme (RHP) in 1994.

THE RIVER HEALTH PROGRAMME

Background

The Department of Water Affairs and Forestry (DWAF) is the custodian of our country’s water resources. This responsibility includes the protection of the ability of river ecosystems to continue to provide goods and services, and in doing so, to protect their use and associated benefits for current and future generations. As a result, DWAF initiated the River Health Programme (RHP) in 1994.

What is the objective of the RHP? This programme is designed to develop a capacity and information base to enable us to report on the ecological state of our rivers, in an objective and scientifically sound manner. At the same time, through river health reporting, the programme aims to be explicit in identifying areas of sustainable utilisation and also to flag areas where deterioration of the river system is causing undesirable changes in the delivery of goods and services.

What does the RHP do? The programme generates information which is based on the assessment of the condition of biological communities in and around rivers (such as fish, aquatic invertebrates, riparian vegetation and river habitats). Together, they provide an integrated measure of the health of river systems.

A collaborative venture

The River Health Programme consists of partnerships that are critical for the success of the programme. At the national level, DWAF plays the lead role while the Department of Environmental Affairs and Tourism (DEAT) and the Water Research Commission (WRC) are key partners. RHP activities are co-ordinated at a provincial level where collaboration plays an important role. Each province has a network of implementers who work together, usually under the leadership of a Provincial Champion.

Why do we need this report? Information about river health tells us about the range and quality of goods and services that a particular state of the river system can deliver. It also tells us about the sorts of impacts that a river system can absorb. This information helps us to manage our rivers because with an understanding of river health we can set goals and decide on action steps for achieving a desired river state that would ensure the provision of a preferred range and quality of goods and services. River health information collected over a period of time also allows us to track changes in river health and therefore our progress towards or away from a defined goal.

WHY IS IT IMPORTANT TO KNOW ABOUT RIVER HEALTH?

People need rivers. Human and economic well-being are directly or indirectly dependent on the goods and services provided by river systems. For example, we obtain drinking water and water for irrigating crops from rivers, we may fish, harvest reeds, have picnics on the river banks or perform baptisms in river pools. Some goods and services provided by rivers are important for human survival, such as water for drinking and subsistence fishing. Other uses of goods and services support social needs (e.g. Recreation such as swimming and economic growth (e.g. agricultural and industrial production).

Some goods and services may be lost, or reduced in diversity, quality and/or quantity, when a river system is impaired. The sustained use of a range of goods and services is therefore directly dependent on the ecological health of a river. (The term “river health” simply refers to the condition of a river. In the same way as health would refer to the condition of a person or an economy). In order to protect our ability to use and benefit from river goods and services over the long term we must look after the health of our rivers and their ability to provide these goods and services.

Legal context of the RHP

The equitable, efficient and sustainable use of our water resources is the central objective of South Africa’s water policy. The National Water Act (1998) recognises that the best way to achieve this would be to manage aquatic ecosystems (including rivers) at the catchment scale and through joint participation by all interested parties. The RHP supports this management process by providing river health information that will be needed by both managers and the participating public to make decisions.

Although the RHP is not specifically mandated by any South African act of parliament, RHP activities and outputs are strongly aligned with legal requirements. 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 contained in the National Environmental Management Act (NEMA) and the National Water Act. For example, RHP results can be used to support evidence of environmental degradation. The law also requires that river protection measures should take into account the characteristics of river and riparian vegetation as well as the characteristics and distribution of aquatic plants and animals.

The RHP also supports the NEMA which is largely concerned with governing the sustainable use of the environment and the protection of ecosystems (including rivers). This act is good for information about the current state of ecosystems as well as changes in state over time, indicating where environmental impacts are occurring and providing guidance for the planning of future developments.

The River Health Programme

The Department of Water Affairs and Forestry (DWAF) is the custodian of our country’s water resources. This responsibility includes the protection of the ability of river ecosystems to continue to provide goods and services, and in doing so, to protect their use and associated benefits for current and future generations. As a result, DWAF initiated the River Health Programme (RHP) in 1994.

What is the objective of the RHP? This programme is designed to develop a capacity and information base to enable us to report on the ecological state of our rivers, in an objective and scientifically sound manner. At the same time, through river health reporting, the programme aims to be explicit in identifying areas of sustainable utilisation and also to flag areas where deterioration of the river system is causing undesirable changes in the delivery of goods and services.

What does the RHP do? The programme generates information which is based on the assessment of the condition of biological communities in and around rivers (such as fish, aquatic invertebrates, riparian vegetation and river habitats). Together, they provide an integrated measure of the health of river systems.

A collaborative venture

The River Health Programme consists of partnerships that are critical for the success of the programme. At the national level, DWAF plays the lead role while the Department of Environmental Affairs and Tourism (DEAT) and the Water Research Commission (WRC) are key partners. RHP activities are co-ordinated at a provincial level where collaboration plays an important role. Each province has a network of implementers who work together, usually under the leadership of a Provincial Champion.

Legal context of the RHP

The equitable, efficient and sustainable use of our water resources is the central objective of South Africa’s water policy. The National Water Act (1998) recognises that the best way to achieve this would be to manage aquatic ecosystems (including rivers) at the catchment scale and through joint participation by all interested parties. The RHP supports this management process by providing river health information that will be needed by both managers and the participating public to make decisions.

Although the RHP is not specifically mandated by any South African act of parliament, RHP activities and outputs are strongly aligned with legal requirements. 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 contained in the National Environmental Management Act (NEMA) and the National Water Act. For example, RHP results can be used to support evidence of environmental degradation. The law also requires that river protection measures should take into account the characteristics of river and riparian vegetation as well as the characteristics and distribution of aquatic plants and animals.

The RHP also supports the NEMA which is largely concerned with governing the sustainable use of the environment and the protection of ecosystems (including rivers). This act is good for information about the current state of ecosystems as well as changes in state over time, indicating where environmental impacts are occurring and providing guidance for the planning of future developments.

A collaborative venture

The River Health Programme consists of partnerships that are critical for the success of the programme. At the national level, DWAF plays the lead role while the Department of Environmental Affairs and Tourism (DEAT) and the Water Research Commission (WRC) are key partners. RHP activities are co-ordinated at a provincial level where collaboration plays an important role. Each province has a network of implementers who work together, usually under the leadership of a Provincial Champion.

Legal context of the RHP

The equitable, efficient and sustainable use of our water resources is the central objective of South Africa’s water policy. The National Water Act (1998) recognises that the best way to achieve this would be to manage aquatic ecosystems (including rivers) at the catchment scale and through joint participation by all interested parties. The RHP supports this management process by providing river health information that will be needed by both managers and the participating public to make decisions.

Although the RHP is not specifically mandated by any South African act of parliament, RHP activities and outputs are strongly aligned with legal requirements. 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 contained in the National Environmental Management Act (NEMA) and the National Water Act. For example, RHP results can be used to support evidence of environmental degradation. The law also requires that river protection measures should take into account the characteristics of river and riparian vegetation as well as the characteristics and distribution of aquatic plants and animals.

The RHP also supports the NEMA which is largely concerned with governing the sustainable use of the environment and the protection of ecosystems (including rivers). This act is good for information about the current state of ecosystems as well as changes in state over time, indicating where environmental impacts are occurring and providing guidance for the planning of future developments.

A collaborative venture

The River Health Programme consists of partnerships that are critical for the success of the programme. At the national level, DWAF plays the lead role while the Department of Environmental Affairs and Tourism (DEAT) and the Water Research Commission (WRC) are key partners. RHP activities are co-ordinated at a provincial level where collaboration plays an important role. Each province has a network of implementers who work together, usually under the leadership of a Provincial Champion.

Legal context of the RHP

The equitable, efficient and sustainable use of our water resources is the central objective of South Africa’s water policy. The National Water Act (1998) recognises that the best way to achieve this would be to manage aquatic ecosystems (including rivers) at the catchment scale and through joint participation by all interested parties. The RHP supports this management process by providing river health information that will be needed by both managers and the participating public to make decisions.

Although the RHP is not specifically mandated by any South African act of parliament, RHP activities and outputs are strongly aligned with legal requirements. 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 contained in the National Environmental Management Act (NEMA) and the National Water Act. For example, RHP results can be used to support evidence of environmental degradation. The law also requires that river protection measures should take into account the characteristics of river and riparian vegetation as well as the characteristics and distribution of aquatic plants and animals.

The RHP also supports the NEMA which is largely concerned with governing the sustainable use of the environment and the protection of ecosystems (including rivers). This act is good for information about the current state of ecosystems as well as changes in state over time, indicating where environmental impacts are occurring and providing guidance for the planning of future developments.
INDEX OF HABITAT INTEGRITY (IHI) - Habitat availability and diversity are major determinants of the suite of fauna and flora found in a specific ecosystem. Therefore, knowledge of the quality of habitats is very important in an overall assessment of ecosystem health. The IHI is designed to assess the impact of major disturbances on riparian ecosystems. Disturbances include water abstraction, flow regulation and river channel modification. The index accounts for both the condition of the riparian zone and instream habitats.

Riparian zone - This provides habitat for aquatic and terrestrial species, contributes towards maintaining the form of the river channel and serves as filters for sediment, nutrients and light. The structure and function of riparian vegetation are altered with vegetation removal, cultivation, construction, inundation, erosion, sedimentation and invasion by alien vegetation within or close to the riparian zone.

Instream habitat - This will vary depending on the substrate, with a wide diversity of habitats supporting a wide diversity of organisms, although some rivers are naturally poor in habitat diversity. Disturbances include excessive sedimentation or scouring of the river bottom, alteration of the water quality by the addition of contaminants, and changes in the natural flow regime of the river due to the presence of dams and/or major abstractions.

The IHI assessment of the uMngeni catchment was not conducted using the full method due to cost constraints. The method used was a “desktop” method that made use of expert local knowledge to answer a range of questions forming a matrix, from which the IHI score was derived.

SOUTH AFRICAN SCORING SYSTEM (SASS) index for aquatic invertebrates - A variety of invertebrate organisms (e.g., insect larvae, snails, crabs, worms) require specific aquatic habitat types and water quality conditions for at least part of their life cycle. Changes in the composition and structure of aquatic invertebrate communities are signs of change in overall river condition. As most invertebrates are relatively short-lived and remain in one area during their aquatic life phase, they are particularly good indicators of localised conditions in a river over the short term (months). The SASS is a relatively simple index that is based on the families of aquatic invertebrates present at a site.

FISH ASSEMBLAGE INTEGRITY INDEX (FAII) - Fish, being relatively long-lived and mobile, are good indicators of longer term influences on a river reach and the general habitat conditions within the reach. The number of species of fish that occur in a specific reach, their sensitivity to various forms of disturbances as well as factors such as different size classes and the condition of fish, can be used as indicators of river health. The FAII integrates such characteristics of a fish assemblage. The output of the FAII is an expression of the degree to which a fish assemblage deviates from what would have been expected in the absence of human impacts. Fish data for the uMngeni catchment were unfortunately not in a format that could be used for the proper implementation of the FAII and no monitoring programmes have yet been implemented for fish assessment in the catchment. As a result, a simpler method had to be used. This “bench-top” method assessed existing (historical) knowledge of the diversity of species and fish habitats, the presence of important or rare species, and the presence of invasive species, in a matrix that gave an overall score. The information used was not always current, so recent changes in the fish population may have been missed.


**River Health Classification**

Once river health indices are measured, they need to be interpreted within a framework that allows us to compare the health of one monitoring site (or river system) with another. An ecoregion classification system was used to delineate ecological boundaries that allow us to assess the health of the uMngeni and uMlazi Rivers.

Ecoregions are regions of broad ecological similarity (see page 8). In other words, rivers that occur within a particular ecoregion will be more similar to each other than to rivers in other ecoregions. For example, the Midmar Dam resource unit in this report (p.34) is divided into two regions, an upper and lower. These are two distinct ecoregions. Variation in natural characteristics such as climate, geology, physiography and vegetation as well as river habitat and the distribution of biota was used to delineate the ecoregions. Because they represent units of ecological similarity, ecoregions provide convenient boundaries within which to do ecological assessments and to set goals for an improved state of the river ecosystem.

**River Health Classes**

The results that are obtained by applying the biological and habitat indices during a river survey provide the information for determining the health of the river. In order to standardise the output of the different indices as well as to allow comparison of the health of different river systems, a river health classification is used. Each index is calibrated so that its results can be expressed as a river health class.

River health classes can be expressed in terms of ecological and management perspectives.

Each of the river health classes is associated with a level of ecosystem health, and the potential to offer a particular range of goods and services. For example, a section of river in a Natural Class may be most suitable for conservation and tourism, and even though it could be used for agriculture, the socio-economic returns on the latter activity might be much smaller compared to the conservation and tourism option. Similarly, a choice could be made whether to use a Good Class river as a source of drinking water, or for agriculture, or for tourism, or some combination of these. A river in the Fair Class may have lost its capacity to serve some of these potential users. An example may be a river that contains salt pollution as a result of providing a service to industry. This river would no longer be ideal for use by agriculture, but this may be considered as acceptable from a management point of view. In the Poor Class, a river’s ability to provide a wide range of goods and services to a range of users is severely compromised. For example, while a highly polluted river continues to provide a service to industry in getting rid of its waste, the detrimental effects of this pollution to others may be unacceptable.

Each river health class represents a combination of human impacts. We need to make decisions around these impacts knowing that:

- our choices affect the state of the river ecosystem and its ability to deliver specified benefits;
- our choices around goods and services affect the opportunity for others to benefit (i.e. there is always a trade-off);
- our choices may affect the opportunity for future generations to benefit; and
- the impacts of our choices cannot necessarily be reversed – easily, or at all.

Each one of our activities within a catchment, indirectly or directly drives changes in river health. It is only when we start to understand how our own and others’ activities affect rivers and their ability to provide us with benefits that we will be able to make wise and fair trade-offs around the mixture of impacts and benefits that will be acceptable to the catchment community.

**State-of-Rivers (SoR) Reporting**

State of the Environment (SoE) reporting led by DEAT, has developed over the past decade in response to a need for appropriate information to assist with environmental decision-making. The national SoE report for South Africa uses the Driving Force-Pressure-State-Impact-Response (DFPSIR) framework to explain what is causing environmental change, how good or bad the conditions are and what we can and are doing about it.

In response to the need for improved environmental reporting this State-of-Rivers (SoR) report, the third one of a series, is designed to:

- assist ecologically sound management of the uMngeni and its neighbouring rivers, so that these rivers can deliver an optimal range of goods and services to people and
- inform and educate the people of South Africa about the state of health of these rivers and the importance of ensuring sustained benefits from them through wise management.

**River Health Class Ecological perspective Management perspective**

<table>
<thead>
<tr>
<th>River Health Class</th>
<th>Ecological perspective</th>
<th>Management perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NATURAL</strong></td>
<td>No or negligible modification of in-stream and riparian habitats and biota</td>
<td>Protected rivers relatively untouched by human hands; no discharges or impoundments allowed.</td>
</tr>
<tr>
<td><strong>GOOD</strong></td>
<td>Ecosystems essentially in good state; biodiversity largely intact.</td>
<td>Some human-related disturbance but mostly of low impact potential.</td>
</tr>
<tr>
<td><strong>FAIR</strong></td>
<td>Sensitive species may be lost; lower abundances of biological populations are likely to occur, or sometimes, higher abundances of tolerant or opportunistic species occur.</td>
<td>Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation.</td>
</tr>
<tr>
<td><strong>POOR</strong></td>
<td>Habitat diversity and availability have declined; mostly tolerant species present; species present are often diseased; population dynamics have been disrupted (e.g. biota can no longer reproduce or alien species have invaded the ecosystem).</td>
<td>Often characterised by high human densities or extensive resource exploitation. Management intervention is needed to improve river health – e.g. to restore flow patterns, river habitats or water quality.</td>
</tr>
</tbody>
</table>
An ecoregion is an area of ecological similarity. This categorisation of rivers is used to make meaningful comparisons between river health scores. Ideally, river sites within one ecoregion will be ecologically similar.

SAVANNAH STREAMS:
- **Veld type:** Dominated by (66%) Ngongoni veld, with 13% Ngongoni veld of Natal mist-belt and 12% Pondoland coastal plateau sourveld
- **Terrain:** A mix of highly dissected undulating mountains, low mountains, undulating hills and lowlands
- **Geology:** 36% shales and siltstones; 23% Natal red-brown sandstones
- **Soil:** 42% well-drained soils; shallow (30%) and poorly drained soils (20%)
- **Average altitude:** 650m
- **Average air temperature:** 18°C
- **MAP:** 890mm
- **MAR:** 100mm

VALLEY BUSHVELD STREAMS:
- **Veld type:** 99% valley bushveld
- **Terrain:** Low mountains (39%) with 27% mountains and lowlands
- **Geology:** 30% granites; 23% Natal red-brown sandstones
- **Soil:** 45% shallow soils on weathering rock; 42% well-drained soils
- **Average altitude:** 700m
- **Average air temperature:** 20°C
- **MAP:** 720mm
- **MAR:** 95mm

SANDY LOWLAND STREAMS:
- **Veld type:** 98% coastal forest and thornveld
- **Terrain:** Dominated by (60%) highly dissected undulating mountains with 21% plains
- **Geology:** 58% Natal red-brown sandstones; 24% granites and shales.
- **Soil:** 60% shallow soils on weathering rock
- **Average altitude:** < 200m
- **Average air temperature:** 20°C
- **MAP:** 940mm
- **MAR:** 200mm

COASTAL BELT STREAMS:
- **Veld type:** 91% coastal forest and thornveld
- **Terrain:** Plains
- **Geology:** 56% beach sands, 39% dune sand
- **Soil:** 59% shallow soils on weathering rock, 25% well-drained soils
- **Average altitude:** < 200m
- **Average air temperature:** 16°C
- **MAP:** 940mm
- **MAR:** 200mm

CATCHMENT STATISTICS

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Size (km²)</th>
<th>Length (km)</th>
<th>Precipitation (mm)</th>
<th>Runoff (mm)</th>
<th>Evaporation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMNGENI</td>
<td>4416</td>
<td>255</td>
<td>410 – 1450</td>
<td>72 – 680</td>
<td>1360 – 2040</td>
</tr>
<tr>
<td>MSUNDUZE</td>
<td>875</td>
<td>115</td>
<td>410 – 1100</td>
<td>72 – 173</td>
<td>1070 – 1360</td>
</tr>
<tr>
<td>MLAZI</td>
<td>970</td>
<td>172</td>
<td>410 – 1100</td>
<td>72 – 137</td>
<td>1070 – 1360</td>
</tr>
</tbody>
</table>

Rainfall strongly seasonal with > 80% falling between October and March.
OVERVIEW OF THE STUDY AREA

The uMngeni and neighbouring catchments form a region of widely varying land uses. These range from conserved natural areas to areas of intense urban and industrial development. The region is one of major economic, cultural and ecological importance and careful planning is necessary if all these needs and activities are to be sustainable.

Grasslands: 32% of catchment
Thicket & Bushland: 17% of catchment
Forestry plantations: 17% of catchment
Cultivated crops and pastures: 18% of catchment
Urban: 12% of catchment
Degraded land: 3% of catchment

Water demand in the uMngeni catchment has outstripped the river’s ability to supply. Without current additional water transferred from the Mooi River to Midmar Dam, the economy of the area would be compromised. Despite effective water demand management, increased future demand is expected and further water import from the uMlazi catchment is being considered. The value and use of other river services (besides water availability) have not been quantified.

ECONOMIC AND SOCIO-LOGICAL PROFILE

The economic information here is based on the uMvoti to uMlazi Water Management Area (WMA), which includes the study area. The Gross Geographic Product (GGP) of the WMA was R26 billion in 2007 (nearly 15% of the SA GGP). The Durban and Pietermaritzburg magisterial districts contributed 57.5% and 11.7% to this figure respectively.

Past economic growth (1988 – 1997) was most notable in the electricity, trade, community services and agricultural sectors.

Current growth:
- Largest contributors to GGP are manufacturing (e.g. metals, machinery, leather, food and paper), trade, government and finance.

Future growth:
- The trade and manufacturing sectors are likely to show the most significant future growth. The informal economic sector is becoming an increasingly important contributor.

Population distribution and density: mostly < 2500 people per km², with very dense populations (between 5000 and over 20 000 people per km²) in the Durban, Pietermaritzburg and Chatsworth areas.
- Population: 64% Black, 17% Asian, 16% White, 3% Coloured
- Language: approximately 76% Zulu, 24% English
- Average annual income per person is R15 100
- Rate of unemployment is 27.9% (national average is 29.3%)
- 56.8% of the population is active in the formal economy
- Sanitation: 63% of households have piped water
- Poverty index (uMngeni catchment) is 0.23 (compared to 0.37 of the WMA), based on economic activity, literacy and service provision criteria

Water use (uMngeni catchment) (% of available water)
- Domestic: 23%
- System Losses (e.g. evaporation): 10%
- Afforestation: 13%
- Water to maintain the river ecosystem: 22%
- Irrigation: 8%
- Distribution Losses: 8%
- Industry: 6%
- Commerce: 6%

Map source: Umgeni Water
Photo: Springfield flats
A resource unit is a sub-catchment of the larger study area that was chosen as a unit of reporting partly because it is a sensible geographic unit for river management, but also because people can relate to sub-catchments (often associated with dams) much better than to ecoregions, which are used by ecologists and managers to make ecological assessments. The uMngeni catchment was divided into six resource units, with several corresponding to the drainage areas of the major dams, while the uMlazi catchment forms a resource unit on its own.

Resource unit information pages are followed by a summary and overviews of river issues of particular interest in these catchments.

**REPORTING FORMAT**

Each page that deals with a particular resource unit shows the same type of information, i.e., an introduction to the resource unit, the present health, drivers of river health, a summary of goods and services derived from the river system and the key management actions that are needed to improve river health in the particular resource unit. Topics of particular interest in any one resource unit are also highlighted and these may deal with drivers, impacts, river goods and services or management responses.

Information was chosen deliberately. National guidelines require that we report on the present health, the drivers of present health and the actions we plan to perform in order to improve river health. But, the report also addresses river goods and services so that we are able to link the types of benefits we derive from rivers with changes to their ecological state, and the way in which we manage these.

- **Goods and services** provided by rivers refer to the river ecosystem processes and products that sustain and support human life. People benefit from the harvest, use and trade of these goods and services and they form a familiar part of our economy. Some of the goods and services that we get from rivers are water for drinking, cooking, washing, power generation, manufacturing, and crop irrigation, food (for example fish and crustaceans), a surface for recreation (and associated tourism), the dilution and processing of pollutants and the provision of building materials (wood, stone, sand).

  A particular state of the river ecosystem enables us to use a particular range of goods and services provided by the river. The use of goods and services also influences (or drives) the state of the river ecosystem. For example, a factory may use river water as a coolant, but at the same time it may return water to the river with an altered chemistry. This process may affect water quality and make it unsuitable for use, or discharge downstream of the factory. Thus, the use of river goods and services bring costs as well as benefits to different users.

- **Management actions**. These refer to what is currently being done, how people should respond to problems (through changes to management strategies and policy), how to make their response more effective and how to prioritise management actions.
Proper fire management is needed, as excessive burning can negatively affect wetland vegetation, damage mist belt forests and impair the soil’s ability to absorb rainwater.

Although the sharptooth catfish (Barbel) is indigenous to KZN, it never originally occurred upstream of Howick Falls. Today it is an alien species in Midmar Dam and upstream!

Water savings through water demand management can be redirected to maintain and improve river health and thus river-based goods and services.

Pollution from the growing Mphophomeni settlement requires management.

Agriculture, in particular dairies, piggeries and maize production, impact moderately on river health through excessive nutrient input into rivers.

The construction of Midmar Dam transformed what used to be a large natural wetland. There are also numerous farm dams in the catchment. See p. 30 for more detail about the impact of dams on river health.

Damage to wetlands is widespread (see page 15).

Plantation forests contribute to excessive sedimentation and destabilisation of riverbanks. These trees (as well as invasive alien plants) also use a lot of water, over-shade the river and displace indigenous vegetation.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.

The construction of Midmar Dam transformed what used to be a large natural wetland. There are also numerous farm dams in the catchment. See p. 30 for more detail about the impact of dams on river health.

The construction of Midmar Dam transformed what used to be a large natural wetland. There are also numerous farm dams in the catchment. See p. 30 for more detail about the impact of dams on river health.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.

The continued loss and degradation of uMngeni wetlands is serious given their positive impact on river health by purifying water, controlling erosion and regulating water flow through the catchment.
Below Midmar Dam, the Umgeni plunges over the 111m-high Howick Falls and into the Umgeni Valley where remnants of midland forest can be seen. The Karkloof tributary then joins before the Umgeni flows into Albert Falls Dam. Approaching Albert Falls, the Umgeni meanders through grassland farm land, where the riparian is treed or invaded by woody alien plants. Below Albert Falls, the river traverses deeply dissected terrain which forms the eastern edge of the Drakensberg Range. At Nagle Dam, the river is at a high elevation (400m above sea level) despite being more than 50km from the coast. The main land use types here are forestry in the west and north and cultivated land, especially sugar cane, and feedlots in the Wartburg area. A large part of the area is hot, dry valley bushveld used for subsistence agriculture. The population of the area is 68,900.

**Water quality**

In this resource unit, water quality is Good although only Fair in the Umgeni Valley. Riparian habitat is in the upper reaches is badly affected by agriculture and forestry although better in the Karkloof Valley. In the lower reaches, riparian habitat is Good despite vegetation encroachment into the river channel. Interspecific competition of the Karkloof Drag is Good and even Natural in the lower reaches. In the Umgeni Valley, the influence of dams affects the flow pattern and water quality. Interspecific competition is noticeable and interspecific competition habitat is only Fair. *Invertebrates* of the Umgeni and Karkloof are in Good condition and even Natural in the lower reaches of the latter. Fish species show the same trend reflected in the presence of invasive species (found in the upper Karkloof, and bass in several basins). Some indigenous fish are also absent here, like the *Mozambique* and *Pompano* bream. The fish in the lower Umgeni are only in Fair condition due to the regulation of the river by dams.

**Bass fishing competition**

- Water releases from Albert Falls Dam (above) are particularly "unnatural" as flows tend to be highest in the dry winter months and low during summer. This flow pattern can disrupt ecological processes (see p.39). At Nagle Dam, bypass gates can be used to mimic a more natural flow pattern.
- A considerable portion of the Albert Falls and Nagle catchments (in the upper reaches) are under plantation forests and invasive alien trees which reduce the flow of water to the river.
- Cattle feedlots below Albert Falls Dam introduce excess nutrients to the river system.
- Efficient discharges from Howick Falls impact on the Umgeni River. Considerable impacts also emanate from the Midmar River where poor land management, and inadequate sanitation contribute to turbidity, nutrient-rich waters.
- Tourism and recreation, especially around Howick Falls, is based largely on and around the river. Mardi Holdings offer a tourist package based on the river and the two large dams that includes game viewing, water-skiing, canoeing and angling.

**Tourism and recreation**

- Angel fish is very popular in this resource unit; not only in the two large dams, but also in the rivers (see page 33). Albert Falls has been considered one of the world’s top bass dams.
- The river carries water to Albert Falls and Nagle Dams which are the main supply reservoirs for the greater Durban area, supplying more than 400 million litres of water per day for mainly domestic and industrial purposes. The river between the two dams carries water from Albert Falls Dam, a storage reservoir, to Nagle Dam, from where the water is piped to Durban.

**Define desirable river health below Midmar and Albert Falls Dams**

- Minimise effluent pollution from the Howick area.
- Promote the passage of young eels past dam walls.
- Minimise overgrazing in the iMpolweni district to reduce excessive sediment input to the river.

**Fish**

- Natural bass populations are found in the Umgeni River below Albert Falls Dam. At Nagle Dam, bass are introduced. *Hydrobates polyomphalus* is a small fish found in fast currents, clinging to the rocky substrate of waterfalls and rapids. *Hydrobates* is sensitive to changing temperatures (especially below dam) and excessive silt in the water. It is found fairly widely in the upper reaches of the Umgeni (especially the Karkloof tributary) and neighbouring rivers.

**A RARE CRUSTACEAN OF THE UMGENI RIVER**

- *Stomatopoda* diameter (left) is a river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.

**A VERY RARE AQUATIC PLANT**

- *Hydrostachys fern-like plant* grows in fast currents, clinging to the rocky substrate of waterfalls and rapids. *Hydrostachys* is a small river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.

**A RARE CRUSTACEAN OF THE UMGENI RIVER**

- *Stomatopoda* diameter (left) is a river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.

**A VERY RARE AQUATIC PLANT**

- *Hydrostachys* *fern-like plant* grows in fast currents, clinging to the rocky substrate of waterfalls and rapids. *Hydrostachys* is a small river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.

**A RARE CRUSTACEAN OF THE UMGENI RIVER**

- *Stomatopoda* diameter (left) is a river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.

**A VERY RARE AQUATIC PLANT**

- *Hydrostachys* *fern-like plant* grows in fast currents, clinging to the rocky substrate of waterfalls and rapids. *Hydrostachys* is a small river crab found in the Umgeni River, discovered here in 1992. This large species favours fast running water and can sometimes be seen climbing the vertical cracks in the rocks in the Albert Falls waterfall.
The uMsunduze is one of the major tributaries of the uMngeni River. It rises near Elandskop on the road to Bulwer (1 500m above sea level) and flows eastward to Hanley Dam, Edendale and Pietermaritzburg. The river flows into the hot, dry Edendale valley, where the river gradient is high and the substrate rocky. Pools are few and small in size and the water tends to be highly turbid with soil eroded from the catchment.

The main land use types here are subsistence cultivation and rural developments with urban areas in the vicinity of Edendale and Imbali. The human population of the area is 278 000. There is also a small area of plantation forestry in the middle of this resource unit.

Water quality is fair, but spoiled by turbidity and faecal contamination, the latter particularly bad in the lower reaches. In the upper reaches the riparian habitat is heavily exploited mainly by stock and by excessive wood harvesting and also due to excessive burning of vegetation during winter. Annual fires are probably not a natural occurrence. In the lower reaches there are also impacts from alien vegetation.

Instream habitat in the upper portion of the area is Good which allows for healthy fish and invertebrate populations. In the lower reaches instream condition is Poor mainly due to the impact of Hanley Dam and water quality issues. Invertebrates upstream and downstream of Hanley Dam suggest that the river is in Good condition. Species diversity is good, and many sensitive organisms are found here.

Fish scores are higher in the upper reaches due mainly to the presence of the Natal mountain catfish which used to occur in the lower reaches as well. Unfortunately bass have invaded both sections.

Dilution and transport of pollutants from the urban/peri-urban areas.

Water to support small-scale agriculture in the upper portion of catchment, with emphasis on stock watering.

Recreation and subsistence fishing.

Reeds from the riparian zone.

Cultural and in particular spiritual activities.

The river is used for clothes washing.

Measures to minimize immediate human health hazard from faecal contamination e.g., complete provision of potable water and sanitation.

Upgrading and improved management of sewage systems.

Control of stock numbers and over-grazing to reduce land degradation.

Reduce frequency of veld fires.

Measures to reduce negative impacts on riparian habitats.

Measures to reduce and control alien vegetation.

Measures to restore riparian vegetation.

Measures to control overgrazing and control of stock numbers.

Measures to reduce the impact of alien vegetation and plant communities.

Measures to protect and manage riparian habitats.

Measures to reduce and control stock numbers.

Measures to protect and manage riparian habitats.

Measures to control and manage alien vegetation and plant communities.

Measures to protect and manage riparian habitats.

Measures to reduce and control stock numbers.

Measures to protect and manage riparian habitats.

Measures to control and manage alien vegetation and plant communities.

Measures to protect and manage riparian habitats.

Measures to reduce and control stock numbers.

Measures to protect and manage riparian habitats.

Measures to control and manage alien vegetation and plant communities.

Measures to protect and manage riparian habitats.
This resource unit is dominated by the urban sprawl of Pietermaritzburg (altitude 750m), a mix of formal city, residential and industrial suburbs and informal housing developments. Here the uMzunduze River enters a canalised reach (an artificial river) at Camps Drift. It then passes through the city in an indirect narrow channel and is joined by small tributaries before picking up treated effluent from Darvill Wastewater Works. Large parts of Pietermaritzburg used to be floodplains and wetlands but the river system is now a shadow of what it was. The total population of the area is 239 500 people.

Water quality in the region is poor mainly due to faecal contamination and declines as the river passes through the city. Interestingly, the effluent from Darvill Wastewater Works often improves the quality of the river water. Of concern is the poor health of both the instream and riparian habitats. Extensive canalisation (particularly at Camps Drift) has significant impacts on the river’s natural flow pattern. Because of poor water quality (eutrophic and turbid water) the habitat is poor for the natural fauna and flora. The decline in the health of the invertebrates from Good to Poor over a few kilometres shows the magnitude of urban impacts. In the lower reaches of the city, only the toughest invertebrates survive, and then in great quantities due to the abundance of organic “food” (i.e. pollutants).

Fish health is Fair to Good, as most of the indigenous species in the area are resilient to pollution. However, alien species abound, especially in the Camps Drift impoundment, where carp and bass are common. The weirs on the river are mostly impassable to migrating fish.

In January each year, the Dusi canoe marathon starts at Camps Drift in Pietermaritzburg and ends at Blue Lagoon in Durban, with some 3000 paddlers participating. The total exchange of money on this event in direct costs i.e. equipment and accommodation, is R20 - 30 million. The marketing value is approximately R300 million, giving an indication of the economic value of a sporting event which relies heavily on adequate river flow and good water quality. The Dusi marathon has redirected much of its income to developments in the rural parts of the catchment.

Dragonflies are familiar to us as the pretty aerial creatures associated with streams and ponds. Young dragonflies (nymphs) live underwater and emerge as adults in late summer and early autumn. They are large and very active, feeding on a variety of insects and other invertebrates. Several local communities make use of the rivers for cultural and religious purposes.

Several local communities make use of the rivers for cultural and religious purposes.
**INTRODUCTION**

Below Nagle Dam, the uMzimkulu River is joined by the uMzunduze tributary and continues in an easterly direction. Towards Inanda Dam, increasing air temperatures and more unpredictable rainfall results in riparian greasland being partly replaced by indigenous tree and shrub thornveld dominated by indigenous acacias. Apart from farmlands around the uMzimkulu, this resource unit is dominated by the rural Valley of a Thousand Hills, a vigorously undergoing landscape with hills and valleys. A large rural population lives here, and many are directly dependent on the uMzimkulu River. The total population of the area is 152 000.

**PRESENT HEALTH**

In the valley bushveld region, the uMzimkulu River **water quality** is Poor, reflecting the impacts of the upstream city of Pietermaritzburg. The uMzimkulu River thus reduces the health of the uMzimkulu River. Aquatic weeds flourish because of high nutrient levels in the uMzimkulu River (see page 23). The riparian zone of this river is in a Good condition despite intensive utilisation in parts, especially in the lower reaches.

**DRIVING FORCES**

- Instream habitat of the uMzimkulu River is Fair. With the combination of poor water quality (caused primarily by excessive nutrients, toxic pollutants and high silt load), the river habitat is unsuitable to the more delicate plants and animals. The instream habitat of the uMzimkulu River is in Good condition.
- Local macroinvertebrates of the uMzimkulu are in a Fair condition, reflecting the Poor water quality coming from the city. The river is home to species of benthic algae and large numbers of hardy species such as midge larvae (Chironomids).
- The Fish in the area are fairly tolerant and have done well despite the poor water quality. Aliens include carp, bass and redbreast tilapia. Invertebrates and fish of the uMzimkulu River are in Good condition.

**GOODS & SERVICES**

- Water flow is affected by the dams upstream. Inanda Dam wall blocks fish migration. Some estuary species would have been present here but are now absent due to Inanda Dam wall.
- In the area of the “Thousand Hills”, the natural vegetation including that of the riparian zone has been much depleted as a result of over-utilisation by a large local population. The area also suffers severe invasion by alien plants. The result is increased erosion and sedimentation of the river, and bank instability both of which reduce river health.
- Overharvesting by subsistence fishermen.
- Aquatic weeds are found throughout the resource unit, including water hyacinth, water lettuce, Kariba weed and parrot’s feather (see page 23).
- Sand mining.
- The instream purification of polluted water is a major service provided by the river, in particular the uMzimkulu.
- Supply of large amounts of good quality water via Inanda Dam to the city of Durban. Also extensive use of water by rural people for riparian agriculture and stock and game watering.
- Sand mining from the river bed is an important activity in the middle reaches.
- Scenic river environment and adequate river flow support a small but potentially much larger tourism industry. The river is Fair. With the combination of poor water quality (caused primarily by excessive nutrients, toxic pollutants and high silt load), the river habitat is unsuitable to the more delicate plants and animals. The instream habitat of the uMzimkulu River is in Good condition.
- Riparian and wetland plants harvested for craft weaving, e.g. ikhwane and imizi.
- Overharvesting by subsistence fishermen.
- Aquatic weeds are found throughout the resource unit, including water hyacinth, water lettuce, Kariba weed and parrot’s feather (see page 23).
- Sand mining.

**PRIORITIES**

- Manage flow releases from Nkangala Dam to meet river-based needs downstream.
- Consider the installation of conduits to allow juvenile migrating fish to climb the dam walls.
- Minimise overgrazing and resultant sedimentation of the river.
- Management of pollution and eutrophication, in particular of the uMzimkulu River.
- Control the spread of aquatic and terrestrial alien plants.

**MANAGEMENT PRIORITIES**

Rivers have an extraordinary ability to purify themselves. Self-purification takes place as the water tumbles over rocks and sand, where huge numbers of invertebrates live together with a coating of microscopic algae, bacteria and other forms of life. These algae and bacteria absorb the nutrients and pollutants contained in the water. Some invertebrates in turn feed on these organisms, while some bacteria convert toxic ammonia to less toxic forms. The activity of all these creatures scrubbs, cleans and filters every millilitre of water, converting pollutants into animal and plant bodies, which in turn feed the next food chain. These processes provide a service that is not viable and seldom appreciated. If rivers are abused to a point where these purification processes are damaged, the consequences for all users of the river could be extreme. The uMzimkulu River is a prime example of a river where these processes play a very important purification role, producing a more acceptable water quality by the time it joins the uMzimkulu.

**MIXED TOWARDS**

**INTRODUCTION**

Below Nagle Dam the uMlazi catchment has also had severe problems, with the main cause being excessive nutrient inputs from Hammarsdale Holiday Resort. blooms of, at times toxic, blue-green algae have been common, making this dam unsuitable for domestic water supplies, and of questionable quality for recreation purposes.

**CONCLUSIONS**

In the early 1990s Inanda Dam became a mass of noxious algae, largely due to the rotting vegetation and humus layer drowned by the rising waters. Since then the dam has stabilised and water quality has improved mainly due to upgrades by Umgeni Water at Darvill Waste Waterworks, that reduced the nutrient load from Pietermaritzburg.

Shongweni Dam (in the neighbouring uMzimkulu River) has also had severe problems, with the main cause being excessive nutrient inputs from Hammarsdale and Pietermaritzburg.

Algal blooms develop when water nutrient levels are high enough to support rampant growth. The nutrients mainly responsible are phosphorus (mostly from detergents and fertilizer) and nitrogen (from sewage and fertilizer). One way to minimize problems associated with algal blooms is to maintain river health by preventing excess nutrients from entering rivers and thus dams.

Algal blooms sometimes impart high costs to water consumers. The cost of removing just the taste and colour imparted by algae at times of a severe bloom (e.g. approximately once in 24 months at Nagle Dam), is significant. Billions of Rand’s worth of chemicals have to be kept at the water works year round, just in case these algae get out of hand.

Algal blooms sometimes impart high costs to water consumers. The cost of removing just the taste and colour imparted by algae at times of a severe bloom (e.g. approximately once in 24 months at Nagle Dam), is significant. Billions of Rand’s worth of chemicals have to be kept at the water works year round, just in case these algae get out of hand.
From Inanda Dam, the uMngeni River flows from the Valley of a Thousand Hills with a gentle gradient for 24 km before it flows out to sea at Durban. This part of the river is extensively modified with riparian vegetation and the channel significantly altered to accommodate human settlement and activities. Historically the uMngeni River entered Durban Bay over a large swampy plain where Durban is now situated. This resource unit is highly urbanised (population 1,314,000). A few smaller rivers are also important here. They include the uMhlatuzana and uMbilo Rivers which rise in the hills above Durban, draining large areas of urban and industrial development before entering the bay.

Water quality in the uMngeni River is Fair, due mainly to the purification of the water in Inanda Dam. Unfortunately by the time the river enters the sea, water quality is Poor from the large volume of city pollutants.

Riparian health is Fair, but is no longer subject to frequent flooding resulting in excessive reed growth and invasion by terrestrial weeds.

Instream habitat (Fair) is affected largely by dam-regulated flows and prevention of the natural supply of sand to the river. This causes silting and closing of the estuary, reducing its contact with the marine environment.

Intensive, large-scale urbanisation and associated modification of the river course.

Canalisation of the uMngeni, uMbilo and uMhlatuzana Rivers has removed natural habitat in the lower reaches.

High population densities and effluent discharges, excessive nutrients and polluted run-off from streets, factory yards and informal settlements.

Upstream activities, dams and bulk water abstractions alter water quality and sediment dynamics, reduce flow and alter the river’s natural flow regime on which many species depend.

Water hyacinth negatively affects the aquatic ecosystem (see p.23).

Estuaries, like rivers, provide us with a wide range of opportunities and benefits. They are an important location for recreational and subsistence activities. The health of estuaries is dependent on the provision of freshwater from the rivers that feed them. By protecting river health, we are also protecting estuaries and the benefits that people derive from them.

The Molweni River, a tributary of the uMngeni at Krantzkloof Nature Reserve near Durban, boasts a freshwater shrimp (Atyoida serrata - large shrimp in photo) only recently found in African waters. It lives exclusively in rocky crevices in torrential water.
The uMlazi River originates south west of Pietermaritzburg at 1 500m above sea level. In the upper uMlazi, the main land-use types are agriculture, forestry and small rural and peri-urban settlements. The river flows through the Bayesfield and Mapstone Dams before entering the Tala Valley, an area of intense commercial agriculture and isolated forestry. From here, the river flows into Thomkwa Dam through the Kilkarey valley and Mjumamba settlement and into Shongweni Dam. Here the river is joined by the Slangkop and Welekele tributaries. Below Shongweni Dam, the river runs through steep sided valleys and then through rural areas down stream of Dassenbold. It then flows through the densely populated areas of Chatavele, uMlazi and the industrial zone near Durban airport (historically a swamp before flowing out to sea through a concrete canal (i.e. an artificial river). The population of the uMlazi catchment is 690 800.

WATER QUALITY OF RIVER REACHES

- NATURAL
- GOOD
- FAIR
- POOR
DAMS AND URBAN RIVERS

The rivers of the uMngeni and uMlazi catchments are heavily regulated by large dams, weirs and smaller farm dams that capture water to provide drinking water and water for irrigating crops. These rivers are also under pressure purely through the large and often dense human population in the area that depends on the products and services that these rivers provide. Dams and urban development have a significant influence on the health of these rivers.

There are 129 registered dams in the uMngeni and uMlazi catchments. Five of these dams can be considered large, namely Midmar, Albert Falls, Inanda, New Germany and Bellair Stream. Dams provide storage capacity for water, contain effluent and provide sites for recreation activities. But they also cause river health problems.

Problems include:
- All the dams on the uMngeni River were built mainly for water supply and are not managed to accommodate downstream ecological needs. As a result, run-off downstream of dams exceeds and has altered habitat. This may result in diminished availability of useful benefits (e.g. less fish and reeds).
- Dams trap sediments and nutrients, resulting in the release of cleaner ‘high-energy’ water downstream. This water erodes sediments from the river. Very clean water may also alter food composition because cleaner water favours predators that use sight to hunt their prey on a very fine basis, while yellowfish are well adapted to turbid water.
- Water released from dams generates downstream flows that are unnatural, leading to changes in the life cycle and (sometimes death of) aquatic fauna. For example a flood in mid-winter can trigger inappropriate cues for breeding and as a result, increased risk of offspring deaths.
- Water spilling over a dam usually contains large numbers of algae. Algae are not typical of fast flowing and turbid rivers such as the uMngeni and introduce a new food source to the system which results in changes to the invertebrate community structure.
- Water released from the bottom of the dam (e.g. Albert Falls and most of the other dams on the uMngeni River) is much colder than the river water and contains dissolved manganese, iron, sulphur and ammonia, all of which are potentially toxic to aquatic life. Some of these problems can persist for more than 20km downstream.
- Reduced flow downstream of a dam can lead to vegetation encroachment, by needs such as Phragmites australis and even terrestrial species, resulting in the narrowing of the river channel. This can have devastating effects in the event of large floods when the river channel can no longer transport the flood waters. Flood waters then tend to uproot plants that are swept downstream where they jam against (and sometimes damage) bridges and other infrastructure.
- Dam drainage is barriers to fish migration. Fortunately on the uMngeni River this impact is minimal as there are only two species that migrate. Fish manage to climb most dam walls, and the yellowfish will make do in suitable areas below the dams.

Dams affect the goods and services delivered by rivers, especially to people who depend on products that are directly associated with the river ecosystem. Fortunately, these impacts can be managed by releasing water from dams in a way that is compatible with downstream needs. Plans are about to investigate this for the uMngeni River.

URBAN RIVERS

More than 12% of the uMngeni and uMlazi catchments is formally or informally urbanised and we can expect this trend to increase in future. An urban setting and high population numbers and densities create a particular set of challenges for river health and this in turn affects the types, amount and quality of river-benefits.

- Increased pressure on water supply; therefore increased pressure to construct water supply infrastructure such as large dams and water transfer schemes.
- Paving/hardening of large areas which alters catchment hydrology and the quality of water which returns to streams and rivers; and
- Increased volume and concentration of solid, domestic, organic and industrial wastes. The box on p.33 provides detail on the impacts of faecal contamination, in particular a severe problem in the uMngeni and uMlazi river systems. The impacts of urban activities on rivers are intense, but at the same time, people in urban environments need and demand much from these rivers – enough clean water for basic needs, effective waste removal as well as a river that provides for recreation activities and which is aesthetically pleasant. We need to reconcile the need for economic growth, human wellbeing and the continued provision of desired goods and services from rivers within an urban setting. We will need to make careful trade-offs among the costs and benefits of our activities in relation to river systems.

RIVERS AND CHOLERA

Cholera is a water-borne bacterial infection associated with a lack of good quality drinking water and sanitation. Although the fatality rate was low (<0.4%) during the 2000/01 cholera epidemic, KZN reported 116 170 cases. During the epidemic, municipal water was safe, but people relying on drinking water directly from rivers and dams were especially vulnerable. The proclivity of cholera is related to HIV/AIDS since people with immune systems weakened by HIV/AIDS are easily attacked by cholera, a highly opportunistic disease.

FAecal contamination and Impacts of informal settlements

One of the major impacts of the fast-growing informal settlements in and around Durban and Pietermaritzburg is the contamination of the streams and waterways with raw sewage. This usually happens where fecal material is either washed from the surface of the ground, or pit latrines are below ground and leach the wastewater. In some developed areas, blocks cause sewers to discharge their load into the nearest river. For example, recently, in the lower uMlazi catchment, more raw sewage has entered the river than finds its way to the treatment plant! Exchewinia coli (E. coli) is a human gut bacterium. Its presence in water indicates faecal contamination. Water should be completely clear of this contaminant if it is to be safe to drink, and even the recreation potential is negatively affected by the presence of E. coli as counts in excess of 400 counts per 100ml (SA Guidelines) will result in a high risk. The following are some recent E. coli results illustrating that the provision of goods and services by these rivers have been compromised by poor management of human activities and infrastructure relating to faecal contamination.

- Mayville Stream, a small stream between Mayville and Westridge Tennis Stadium, E. coli up to 290 000 per 100ml of water. (Cause: Informal communities - inadequate sanitation)
- Botha Stream, e. coli up to 310 000. (Cause: Informal community - inadequate sanitation)
- Alior River, New Germany, E. coli up to 400 000. (Cause: Informal community - inadequate sanitation)
- uMhlangaan River above Kwamashu waste water works, E. coli up to 240 000. (Cause: Broken sewers in Kwamashu Township)
- Isipingo River above Isipingo waste water treatment works, E. coli up to 30 000 000 and exceeding 200 000, 60% of the time. (Cause: Broken sewers in uMlazi Township)
- uMngeni River at Kennedy Road, E. coli up to 1 100 000. (Cause: Informal Community on the banks of the Palmiet River). This is an example of the impact that a community on a small river can have on a larger river!
- uMlazi River below Fongoa Stream, E. coli up to 720 000. (Caution informal settlement in an urban area)
- The Slangkop River below Pietermaritzburg and the Bayespruit within the city boundaries, have recently contained E. coli counts of 670 000 and 610 000 per 100ml respectively.
FISH OF THE UMNGENI RIVER

The uMngeni River boasts 48 species of freshwater (FW) fish (36 indigenous and 12 alien), listed here. A further 57 species are found in the estuary that do not come into fresh water. These have not been shown here.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species name (# means alien)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>rivestream</td>
<td>Acantthophagus berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>longjawed goby</td>
<td>Ambassis productus</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Natal mountain catfish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>African mottled eel</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Mozambique tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>longfin eel</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Natal barb</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>redtail Barb</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>straightfin Barb</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>bowstripe Barb</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>ducktail sleeper</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>goldenfish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>sharpnose catfish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>grass carp</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>carp</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>dusky sleeper</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>blacknose goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>African softnose goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>river goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>tank goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>golden goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>scaly / KZN yellowfish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>taung</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>river snapper</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>opossum or platfish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>freshwater pipefish</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>smallmouth bass</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>spotted bass</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>longfin mouth bass</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Natal moony</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Cape moony</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>flathead mullet</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>freshwater mullet</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>rainbow trout</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>Mozambique tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>southern mouthbroader</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>checked goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>brown trout</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>beardred eelgby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>redbreast tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>banded tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>swordtail</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>chubbyhead barb</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>checked goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>freshwaters mullet</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>redbreast tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>southern mouthbroader</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>checked goby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>brown trout</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>beardred eelgby</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>redbreast tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
<tr>
<td>banded tilapia</td>
<td>Anguilla berda</td>
<td>FW/estuarine</td>
</tr>
</tbody>
</table>

Some of the more interesting indigenous species include:

- The longfin eel is the most common eel found in this river system. Tails breed at sea and juveniles migrate up rivers, even climbing waterfalls and dam walls.
- The yellowfin eel, nowadays much sought after by flyfishers, and the redtail barb are endemic to KwaZulu-Natal, i.e. found only in this province.
- The Nalal mountain catfish is a small scaleless species normally associated with mountain foothill streams.
- The flathead mullet and freshwaters mullet ( endemic) are common in fresh waters near the coast and occur up as far as Inanda Dam.
- Four tilapia species are found in the uMngeni system. The redbreast tilapia has been translocated from the Rongolo system into farm dams, where it has made a valuable impact on over-abundant water weeds. The Mozambique tilapia, the banded and the southern mouthbroader occur naturally in the uMngeni system.
- The golden sleeper is an attractive and scarce species found in a few streams near the mouth of the uMngeni, but not in the main river.
- There are five scarce goby species and one scarce electra species found in the estuary area. All are small and lack colour and so are not very noticeable. Of these, the beardred eelgby lives in burrows in soft mud and is endemic to the estuary.

FISHING

The uMngeni River and its bigger tributaries have indigenous and introduced fish species and thus offer a range of options to fishermen. Trout angling is popular in the headwaters and has been since around 1885 when the first trout hatchery was built near Belingham. Midmar Dam catches include barbel, carp and the KZN yellowfish during spring.

Between Howick Falls and Albert Falls Dam, the river is rocky with fast flowing water - ideal habitat for the KZN yellowfish which is also a popular catch here. The Albert Falls Dam itself is an excellent angling venue. While the fish species are much the same as in the Midmar Dam the warmer water and abundance of submerged trees result in greater growth and the capture of more trophy size specimens.

Downstream of Albert Falls, the river is well known for its carp but further downstream the KZN yellowfish and catfish are popular to both recreational and subsistence fishermen. Niguel Dam provides good catches of carp, tilapia and catfish, but neither Niguel or Inanda Dam are considered prime fishing venues.

Blue Lagoon, with its additional saltwater species, was historically a hive of fishing activity but deterioration in river health and situation of the estuary led to a decline in the angling. Recently, however, the estuary has seen a resurgence in angling popularity. Light tackle anglers in particular are now common here and catch a variety of species such as longfish, spriggin, and garumets. These are all marine fish but hopefully this indicates that the estuary is once again becoming a nursery for many fish species.
A HISTORICAL DESCRIPTION

OF THE UMNGENI RIVER

This report tells us about the current state of the uMngeni and neighbouring rivers. Why would it be important to examine how these rivers looked and behaved in the past? By understanding something of the historical state of these rivers, we are made aware of the goods and services they provided back then and how these may be different from the present situation. This comparison gives an indication of the trajectory we are on in relation to our rivers so that we can try to manage, and perhaps restore the benefits we got from them.

We are fortunate that the vision of various people in the 1950s and 1960s resulted in fairly detailed surveys of the uMngeni River. These were published by the CSIR and the Town & Regional Planning Commission. But, these reports document the river in an already impacted condition. Earlier knowledge of the uMngeni River in the upper parts of the catchment is limited, other than from incidental reference made in various texts. Because of the development of Plettenberg Bay, some information on the uMndune is available mostly in the form of old photographs. There is considerably more information about the river estuary and its relation to Durban Bay, as this was an important resource for the settlers in the early 1800s.

The uMngeni Estuary

Information on the meanderings of the uMngeni estuary is confusing and scant. It appears that the position of the estuary has changed repeatedly, not only north and south along the coast, but at times the uMngeni River flowed directly into Durban Bay. Russell (1899) noted that the name uMngeni means "River of Entrance" because the ancient uMngeni flowed into Durban Bay via a low-lying area known as "Eastern Head." But, a map of Durban drawn by Lt. King in 1823 (p.40) shows the river clearly entering the sea in approximately its current position, with little sign of a pathway to the Bay. A 1909 Mercury Pictorial (9th September) reported that the estuary had marched "three miles" from its present position towards Durban. Concern was expressed and the estuary was manually redirected towards its current position. This probably happened repeatedly.

From an old account written in the late 1600s, the author describes what is now Durban where the mouth of the river is clearly the Bay itself: "Neither is there any want of water for every hill affords little brooks, which glide down several ways, some of which meet by degrees, which make up the river of Natal (uMngeni River), which discharges into the sea (Indian Ocean), in latitude 30° S, where it opens pretty wide, and is deep enough for small ships. But at the mouth of the river is a bar, which has not above 10 or 11 feet of water at high-water, nor in a spring tide, though within there is water enough. This river is the principal of the country of Natal, and has lately been frequented by some of our ships, particularly by a small ship that Captain Rogers owned (Dampier's Voyages British Museum - repeated in Bird 1888).

According to Hattersley (1936) who described Durban in the 1800s: "Then as now, the beach (in Durban Bay) was the centre of amusement. The boys fishing for eels in the big pond, formed in the "dip" in West St, the Umgeni with the bay, provided favourite sport in the days before building operations covered the swampy ground between Field St and Gardiner St. At low spring tide, it was very nearly possible to walk on dry sand across to the Bluff, and the channels could be easily watched by those who did not fear sharks. North of the Point, the little-used ocean beach swarmed with white crabs." Hattersley, MA (1936).

Cooper & Mason (1887) say the following of the meandering estuary: "...the umgeni River flowed southward between the Berea Ridge and a line of coastaldunes before discharging into Natal Bay. This former course is marked by thick estuarine deposits beneath Durban and is visible on satellite images of the Natal coast. In a chart of 1863 this former course of the uMngeni is marked by a series of marshes."

In 1856 a great flood laid waste the Springfield Estate along the Umgeni, which had the first Natal-grown sugar for sale on the Durban market (Hattersley 1936).

Descriptions of Durban Bay

"I stood in amazement at the grandeur of the scene. Everything was primitive, the hands of men had not defaced it. The inner Bay was like a sheet of silver, the home of wild fowl that had never frightened. I thought the Bay the most beautiful sight that I had ever seen. But the sunset that evening in May with the golden tints begged any description that I can give. I have never seen the like before in Ireland, where I came from. The beautiful Berea untouched, all one sheet of evergreen, and the home of elephants and other animals.”

The uMngeni River in Durban

The town that became Durban developed on the flat plain at the base of the Berea. The scant vegetation rapidly became a mass of loose blown sand, which drove the inhabitants to distraction. The Anglican Bishop of Natal, Bishop Colenso, wrote the following account of the drinking water in the town: "A greater evil in Durban is the water, which is usually taken from wells, that are not sunk deep enough, and consequently abound with decayed vegetable, fish, and innumerable animals and worms... At present, the remedy is to drink rain water, or the water of the Umgeni River, which is brought by carriers a distance of four miles and is excellent. Indeed, had the Dutch founded the town of Durban, as they did that of Mauritius they would long ago have had the Umgeni pouring its beneficent streams through every street, and bringing health and cleanliness to every door. How long will it be before the public spirit of Englishmen will achieve this?" (Durban's water supply was..."
not materially improved until HW Currie sunk a well in 1879 (Curries Fountain) in the vicinity of the present Botanic Garden. Bishop JW Colenso (1854) in Hattersley (1936).

Alfred Delegorgue describes going on a hippo hunt in the Seekoei Vlei, now dominated by the N2 road, sewage works and a new garage development. All that remains of what was the scene described below, are some reeds and a small polluted lake. The rest of the area is drained by a system of canals. “After we had crossed the sandy bed and forded the beautiful river (the uMngeni), another challenge faced us in the guise of…we pitched our tent on the inviting green promontory… the slope was so gentle, the grass so short, the top of the little hill so well placed between the crocodiles and hippopotamuses… Musquitoes attacked us in their millions, finding their way under our bed clothes which gave no protection, invading our noses, our ears, our eyebrows and our beards.” (1848 - Delegorgue).

Pietermaritzburg

The town of Pietermaritzburg was distinguished in the early 1840s by the furrows of flowing water that carried water from the Little Bushman’s River (the Dorpspruit) which carried the same name as the uMsunduze down the length of all of the streets. The water was abstracted from just below the entrance to the Botanical Gardens to a point at the top of Longmarket St for a period of 40 years (Milneke and Summer, 1963). Each property owner was responsible for maintaining the furrow past his/her property, and the custom was to draw water into barrels in the early morning of each day, when water quality was likely to be at its best. This water provided an important service to the citizens, even though peddlers occasionally fell into them by accident at night. Crabs abounded in these furrows, to the delight of the town’s children.

In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.” A further report notes that: “There is no record of when the first weeping willows were planted in this part. The original cutting which became the parent tree of all weeping willows in South Africa was taken from a tree at Napoleon’s grave at St. Helena.” Miss Smythe – History of Nottingham Road 1850-75 (in Hattersley, 1936).

The uMsunduze River was the venue for most swimming activities in Pietermaritzburg. Each February the annual swimming gala was held, including a race of 100m part of which was sewn upstream. In 1896 the event was interrupted by a sudden spate that washed away the officials’ raft and the military marquee on the banks, tables, chairs and all! A severe drought in Pietermaritzburg (489mm rain -53% of average) during 1931, coupled to the Great Depression, was accompanied by an outbreak of malaria that moved inland from the coast.

In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

A severe drought in Pietermaritzburg (489mm rain -53% of average) during 1931, coupled to the Great Depression, was accompanied by an outbreak of malaria that moved inland from the coast. In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

A severe drought in Pietermaritzburg (489mm rain -53% of average) during 1931, coupled to the Great Depression, was accompanied by an outbreak of malaria that moved inland from the coast. In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

A severe drought in Pietermaritzburg (489mm rain -53% of average) during 1931, coupled to the Great Depression, was accompanied by an outbreak of malaria that moved inland from the coast. In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”

A severe drought in Pietermaritzburg (489mm rain -53% of average) during 1931, coupled to the Great Depression, was accompanied by an outbreak of malaria that moved inland from the coast. In 1875 the uMsunduze in Alexandra Park was shaded by large weeping willows (Hattersley, 1936). Bishop Colenso noted in 1854 that the willow trees were only eight to ten years old, and were already “very fine in their growth.”
The wildlife in the 1800s

Interesting species were recorded by Wahlberg (1838-1856) and Delegorgue (lived 1814 - 1850, visited Pietermaritzburg 1839 ) both of whom were avid collectors of specimens. Wahlberg sent several thousand of these, from insects to hippo, to Swedish where many are still preserved. Many of the species below we would hardly associate with these areas any more.

**Durban**
- Side necked turtles (Pelomedusidae) in the Bay
- Fiddler crabs
- Pythons were common
- Great snipe (not seen for many years)
- Black-breasted snake eagle
- Woolly-necked stork
- Cuckoo hawk
- Bateleur eagles were common
- Goliath heron
- Giant eagle owl
- Marabou
- Red duiker
- Southern reed buck
- Leopard
- Buffalo
- Lion
- Elephants in herds of more than 1000
- Enormous swarms of locusts

**uMngeni river**
- Marabou stork
- Saddle-billed stork
- Marsh owl
- Mayflies were a staple diet of
- Bustards and Black kite
- Ratel/honey badger
- Wattled crane (rare)
- Samango monkey
- Guinea fowl
- Green dove
- Crested guinea fowl
- Short-eared owl
- Bushbaby
- Hippos and crocodiles in
- Seekoei Valley

**uMlazi estuary**
- Namaqua dove
- Jacana

**Pietermaritzburg**
- Mozambique spitting cobra
- Klipspringer
- Grey rhebok
- Red buckle (Southern reed buck)
- Oribi
- Duiker
- Jackal
- Leopard
- Hyena
- Ground hornbill
- Snake
- Bald ibis
- Blue swallow
- Haries
- Cane rats were common on the banks of the uMlazi

**The Umlazi**

"In 1868, when I was nine, we children were taken to see Victoria Bridge, over the Umbundu, which had collapsed in the centre through the river raging far over its banks in the floods. A drift was made above where the bridge was, which was used for traffic...in Loop Street, near Buchanan Street, was a mill, Van der Planck's I think it was called. A very strong stream of water leading into Burger Street turned the wheel. Often and often, we children watched the mealies being ground into meal."  

Mrs. G. Lamond Narrative of Family History, Natal Archives - Hattersley)
LOCAL CULTURAL HISTORY

The Zulu people acknowledge water spirits including the river snake, the ‘snake of the waters that gives life’. This belief system unites people, both the living and the dead, with natural forces, the non-human spirit world and the supreme deities. The ideal pool for ceremonies involving the river snake (e.g. diviner submersion) contains ‘living water’, and usually is below a waterfall where the water is turbulent and deep.

Reeds are also a key symbol for the Zulu people, as they believe that their people emerged from a bed of reeds in ancient times. The reed mat is therefore an essential part of the diviner’s habitat, and is directly linked to its association with water, healing and creation.

In some areas of KZN it is believed that the heavenly princess, iNkosazana has rest days where she needs to have the river to herself. Accordingly the use of the river on her day - Isuku-lekho (Mondays and Sundays) is strictly prohibited.

Besides bathing, ceremonial use of the river is its most common use, with the supply of building materials, recreation and clothes washing being of lesser importance.

A degraded river reduces the acceptability of the river for ceremonial purposes. Almost all of the people in Salem acknowledge that respect for the river and its attributes for cultural and religious ceremonies are diminishing.

This report is based on data that has been accumulated by several organisations over a number of years. The bulk of the information came from Umgeni Water’s monitoring programme, with details of the Durban area coming from eThekwini Water Services.

Other valuable contributions were made by Emilia van Wyk (CSIR - editor), Dirk Roux (RHP co-ordinator), Wilma Smythorn (State-of-Rivers reporting co-ordinator), Neels Klap勤劳 (WCD - fish and river habitat specialist), Chris Daldin (Umgeni Water - data, data and photography), Mark Graham (Umgeni Water - data and photography), Tochie Bolokwe (Umgeni Water - data), Colbo Mthethwa (Umgeni Water - meteorologists), Kim Hodgson (Umgeni Water – water quality), Nontsile Simelane and Alia Ramathum (Umgeni Water - GIS maps). Mike coke (fish specialist), Hugh Dixon-Paier (DiAW - aquatic weeds), Charlie Joubert (DiAW - squatter settlements), Stan Jacobs (Umgeni Water – alien eradication), Steve Terry (Umgeni Water – pollution, lower Umgeni – reeds and photography), Ian Bailey (Umgeni Water – Dusi marathon), Neel Quinn (University of Natal – botany), Bob Craig (long time enthusiast and expert – trout), Jake Adelsrohn (Adelsrohn Biological Ecologists – angling), Roy Wadman (WRR Environmental – geomorphology), Angus Burns (Umgeni Irrigation Board – aquatic conservation), Kathleen Gordon-Grey (long time expert – riparian vegetation), Mike Semmens (University of Natal – drakensberg), Bob Markham (Mrani Holdings – dam recreation), Don Kotze (University of Natal – wetlands), Tony Bailey and Sibonani Jackson (eThekwini Municipality – water quality), Shamilla Nkutumising (University of Durban-Westville – meteorologists data, Natal Witness, Natal Museum and Kili Campbell Library (historical pictures), Paul Skilton (South African Institute for Aquatic Biodiversity – fish sketches), Department of Environment Affairs, Cape Town (satellite images), Fandy de Moor (Albany Museum – picture – extent maps), Penny Barnard (Rhodes University – cultural aspects), CA Thinn (University of Natal – cultural aspects), Sunday Tribune (Durban picture).